UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

ENVIRONMENTAL ASSESSMENT

for

BIRD DAMAGE MANAGEMENT AT MUNICIPALITIES, INDUSTRIAL SITES, AGRICULTURAL SITES, AND PRIVATE LAND WITHIN INDIANA

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1.1 Introduction

The United States Department of Agriculture (USDA) is authorized and directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services (WS) program is the Act of March 2, 1931, as amended (7 U.S. C. 426-426c; 46 Stat. 1468) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 (P.L. 100-202). WS activities are conducted in cooperation with other federal, state and local agencies; and private organizations and individuals. Federal agencies, including the United States Department of Interior, Fish and Wildlife Service, recognize the expertise of WS to address wildlife damage issues related to migratory birds.

Wildlife damage management (including birds), or control, is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife. It is an integral component of wildlife management (Leopold 1933, the Wildlife Society 1990, Berryman 1991). The WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as Integrated Pest Management or IPM) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of The Animal Damage Control Program Final Environmental Impact Statement (USDA 1997). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The control of wildlife damage may also require that the offending animal(s) be removed or that populations of the offending species are reduced through lethal methods.

WS's mission is to "provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety." This is accomplished through:

A) Training of wildlife damage management professionals;
B) Development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
C) Collection, evaluation, and dissemination of management information;
D) Cooperative wildlife damage management programs;
E) Informing and educating the public on how to reduce wildlife damage and;
F) Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1989).

This Environmental Assessment (EA) evaluates ways by which this responsibility can be carried out to resolve conflicts with birds at municipalities, industrial sites, agricultural sites, and private land within Indiana.

WS is a cooperatively funded and service oriented program. Before any operational wildlife damage management is conducted, WS and the cooperator (land owner/administrator, property manager, or designated representatives) must complete Agreements for Control or WS Work Plans. WS cooperates with private property owners and managers and with appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable federal, state, and local laws.

Individual actions on the types of sites encompassed by this analysis may be categorically excluded under the APHIS Implementing Regulations for compliance with the National Environmental Policy Act (NEPA) (7 CFR 372.5(c)). APHIS Implementing Regulations also provide that all technical assistance furnished by WS is categorically excluded (7 CFR 372.5(c)) (60 Federal Register 6,000, 6,003 (1995)). WS has decided to prepare this EA to assist in planning bird damage management (BDM) activities, and to clearly communicate with the public the analysis of cumulative impacts for a number of issues of concern in relation to alternative means of meeting needs for such management at municipalities, industrial sites, agricultural sites, and private land within Indiana. This analysis covers WS's plans for current and future BDM actions wherever they might be requested.

This environmental assessment (EA) documents the analysis of the potential environmental effects of the proposed program. This analysis relies mainly on existing data contained in published documents, primarily the Animal Damage Control Final Environmental Impact Statement (USDA 1997) to which this EA is tiered. These WS

activities will be undertaken in compliance with relevant laws, regulations, policies, orders, and procedures including the Endangered Species Act.

A Notice of Availability of the draft environmental assessment (pre-decisional) was published consistent with APHIS NEPA procedures to allow interested parties the opportunity to obtain and review the document and comment on the proposed management activities.

1.2 Purpose

The purpose of this EA is to analyze the effects of WS activities on municipal sites, industrial sites, agricultural sites, and private land within Indiana to manage damage caused by the avian wildlife species.

Avian bird species may include, but are not necessarily limited to the following. House sparrow (*Passer domesticus*), Red winged black birds (*Agelaius phoeniceus)*, European starlings *(Sturnus vugaris*), Brown headed cowbirds (*Molothrus ater*), Easterm Meadow Larks (*Sturnella magna)*, Horned larks (*Eremophila alpestris)*, Killdeer (*Charadrius vociferus)*, Canada Geese (*Branta canadensis)*, Snow Geese (*Chen caerulescens)*, Mallards (*Anas platyrhynchos*), Other Ducks (Anatinae), Terns (Sterninae), Gulls (Larinae), Short-eared Owl (*Asio flammeus*), Great Horned Owl (*Bubo virginianus*), Barred Owl (*Strix varia*), Red-tailed Hawk (*Buteo jamaicensis*), Rough-Legged Hawk (*Bueto lagopus*), American Kestrel (*Falco sparverius*) , Swansion's Hawk (*Buteo swainsoni*) , Northern Harrier (*Circus cyaneus*), Wild Turkey (Meleagris gallopavo), Mourning dove (*Zenaida macroura*), Rock dove (*Columba livia),* Purple finch (*Carpodacous purpureus*), House finch (*Carpodacous mexicanus*), Barn swallow (*Hirundo rustica*), Cliff swallow (*Petrochelidon pyrrhonota*), American crow (*Corvus brachyrhnchos*), Turkey vultures (*Cathartes aura*), Black vultures (*Coragyps atratus)*, Common grackles (*Quiscalus quiscula*), Blue Jay (*Cyabicutta crustata*), Eastern bluebird (*Sialia sialis*), Northern Cardinal (*Cardinalis cardinalis*), Upland sandpiper *(Bartramia longicaude*), and Common snipe (*Capella gallinago*).

Resources protected by such activities include property, agriculture, natural resources, and human health and safety.

1.3 Need For Action

1.3.1 Summary of Proposed Action

The proposed action is to continue the current WS program that respond to requests for BDM at municipalities, industrial sites, agricultural sites, and private land within Indiana to protect property, agriculture, natural resources, and human health and safety at these locations. An Integrated Bird Damage Management (IBDM) approach would be implemented which would allow use of any legal technique or method, used singly or in combination, to meet request or needs for resolving conflicts with birds affecting the aforementioned properties (Appendix B). Those requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Lethal methods used or recommended by WS may include shooting, trapping, toxicants, or euthanasia following live capture by immobilization drugs or trapping. Non-lethal methods used or recommended by WS may include habitat alteration, chemical immobilization, repellents, fencing, barriers and deterrents, netting, capture and relocation, and harassment or scaring devices. In many situations, the implementation of non-lethal methods such as habitat alteration, structural modifications, and exclusion-type barriers would be the responsibility of the property managers to implement. BDM by WS would be allowed on the aforementioned sites, when requested, where a need has been documented and upon completion of an Agreement for Control. All management actions would comply with appropriate federal, state, and local laws.

1.3.2 Objectives for the Wildlife Services BDM Program at Municipalities, Industrial sites, Agricultural sites, and Private land within Indiana

The purpose of the proposed action is to minimize the threat to human health and safety and damage

to property, agriculture, and natural resources.

Specific objectives:

* To protect agricultural resources, natural resources, property, and public health and safety from damage caused by injurious wild bird species
* To promote biologically sound wildlife management techniques in the resolution of human/wildlife conflicts
* To promote Integrated Pest Management (IPM) in the use of chemical control tools to resolve human/wildlife conflicts

1.3.3 Need for Injurious Bird Damage Management to Protect Property

The state of Indiana contains similar types of habitat such as woodlands, wetlands, grasslands, croplands, and suburban areas. Thus, properties (industrial sites, municipal facilities, utilities, private properties) in Indiana may deal with similar types of hazards caused by birds. Birds create a variety of problems at such properties that can negatively affect equipment, structures, service deliveries, public areas and products. Bird damage results in millions of dollars in direct and indirect damages. The large accumulations of bird droppings associated with nests and roosts causes damage to landscaping, structures, sidewalks, vehicles and equipment, and can harbor transmissible zoonotic diseases.

Birds occasionally damage structures on private property or public facilities with fecal contamination. Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Corrosion damage to metal structures and painted finishes, including those on equipment and parked automobiles, can occur because of uric acid from bird droppings. Vultures tear and consume latex window calking or rubber gaskets sealing window panes, rubber roof linings, asphalt and cedar roof shingles, vinyl seat covers from boats and tractors, and plastic flowers at cemeteries (Lowney 1999). Black vultures have been observed depredating on livestock including pigs, calves, goats, horses, cats, dogs, and turkeys (Lowney 1999, Lovell 1947, Lovell 1952, Parmalee 1954, Roads 1936, Sprunt 1946). Roof-top colonies of nesting gulls have been well documented and frequently cause damage to urban structures. Gulls transport large amounts of nest material and food remains to the roof-tops which can obstruct roof drainage systems and lead to structural damage to buildings (Vermeer et al. 1988, Blokpoel and Scharf 1991, Belant 1993). Pigeons, starlings and house sparrows sometimes cause structural damage to the inside of buildings. These birds often roost or nest in the rafters of the buildings where they damage the insulation, and wiring. For example, an Indiana pharmaceutical company suffered over $165,000 in loss of product and clean-up and repair costs to their facilities caused by a single bird feather (WS Annual Report, 2000). Other industrial sites have suffered similar damages.

Blackbirds, European starlings, house sparrows, and, to a lesser extent, feral domestic pigeons and crows often cause damage at cattle feeding facilities and dairies by congregating in large numbers to feed on the grain component of cattle feed. Such feeding strategies present disease threats to livestock at such sites. The birds also cause damage by defecating on fences, shade canopies, and other structures, which can accelerate corrosion of metal components and which generally is considered an unsightly nuisance and potential health hazard for the feedlot/dairy operators and their personnel.

The problem of starling damage to livestock feed has been documented in France and Great Britain (Feare 1984), and in the United States (Besser et al. 1968). The concentration of larger numbers of cattle eating huge quantities of feed in confined pens results in a tremendous attraction to European starlings, blackbirds, and feral domestic pigeons. Diet rations for cattle contain all of the nutrients and fiber that cattle need, and are so thoroughly mixed that cattle are unable to select any single component over others. The basic constituent of most rations is silage and the high energy portion is usually provided as barley, which may be incorporated as whole grain, crushed, or ground cereal. While cattle cannot select individual ingredients from that ration, European starlings can and do select the barley, thereby altering the energetic value of the complete diet. The removal of this high energy fraction by European starlings, is believed to reduce milk yields, weight gains, and is economically critical (Feare 1984). Glahn and Otis (1986)

reported that starling damage was also associated with proximity to roosts, snow, and freezing temperatures and the number of livestock on feed.

The economic significance of feed losses to European starlings has been demonstrated by Besser et al. (1968) who concluded that the value of losses in feedlots near Denver, Colorado was $84 per 1,000 birds in 1967. Forbes (1995) reported European starlings consume up to 50% of their body weight in feed each day. Glahn and Otis (1981) reported losses of 4.8 kg of pelletized feed consumed per 1,000 bird minutes. Glahn (1983) reported that 25.8% of farms in Tennessee experienced starling depredation problems of which 6.3% experienced considerable economic loss. Williams (1983) estimated seasonal feed losses to five species of blackbirds (primarily brown-headed cowbirds) at one feedlot in south Texas at nearly 140 tons valued at $18,000.

1.3.3.1 Need for Bird Damage Management to Protect Agricultural and Natural Resources

Birds also pose a serious threat to agricultural and natural resources. Canada geese, Double crested cormorants, Great blue herons, Mallard ducks, Feral pigeons, European starlings, American crows and other black bird species can cause damage to these resources through predation and other feeding behaviors, nesting, roosting, and by deposition of large quantities of fecal material and other debris. According to National Agricultural Statistical Services 2002 report on U.S. Wildlife Damage states that American crows, Wild turkeys, Canada geese, and other birds were responsible more than $7.8 million in damage to agricultural resources in 2001(Loven, 1999 personal communication). This figure only reflects direct damage to the agricultural resource, and does not include associated losses such as consumption/contamination of livestock feeds, damages to barns and other structures, and the costs of repairs and replacement. Wild birds also transmit diseases to livestock and poultry (Loven, 1999 personal communication). These diseases include Salmonellosis, New Castle Virus, Avian influenza, and possibly tuberculosis.

Several studies have shown that blackbirds and European starlings can pose a great economic threat to agricultural producers (Besser et. al. 1968, Dolbeer et.al. 1978, and Feare 1984). Fruit or nut crops, especially pecans, can be severely damaged by blackbirds and American crows. Starlings and sparrows can also have a severe detrimental impact on agricultural food production by feeding at vineyards, orchards, gardens, cropfields, and feedlots (Weber 1979). For example, starlings feed on numerous types of fruits such as, cherries, figs, blueberries, apples, apricots, grapes, nectarines, peaches, plums, persimmons, strawberries, and olives (Weber 1979). Starlings were also recently found to damage ripening corn (Johnson and Glahn 1994) and are known to feed on the green, milk and dough stage kernels of sorghum (Weber 1979). Additionally, starlings may pull sprouting grains, especially winter wheat, and feed on planted seed (Johnson and Glahn 1994). Sparrows damage crops by pecking seeds, seedlings, buds, flowers, vegetables, and maturing fruits (Fitzwater 1994), and localized damage can be great because sparrows often feed in large flocks on a small area (Fitzwater 1994).

Soil erosion and sedimentation can cause damage to natural resources. Excessive numbers of waterfowl can remove bank vegetation resulting in erosion of the shoreline and soil sediments being carried by rainwater into lakes, ponds and reservoirs. Waterfowl may cause damage to natural vegetation, shorelines, parks, ponds, and lakes.

Nutrient loading has been found to increase in wetlands in proportion to increases in the numbers of roosting geese (Kitchell et al. 1999, Manny et al. 1994). In studying the relationship between bird density and phosphorus (P) and nitrogen (N) levels in Bosque del Apache National Wildlife Refuge in New Mexico, Kitchell et al. (1999) found an increase in the concentration of both P and N correlated with an increase in bird density. Scherer et al. (undated) stated that waterfowl metabolize food very rapidly and most of the phosphorus contributed by bird feces probably originates from sources within a lake being studied. In addition, assimilation and defecation converted the phosphorus into a more soluble form and, therefore was considered a form of internal loading. Waterfowl have contributed substantial amounts of P and N into lakes through feces creating excessive aquatic macrophyte growth and algae blooms (Scherer et al. undated) and accelerated eutrophication through nutrient loading (Harris et al. 1981).

Waterfowl are considered by the American Association of Wildlife Veterinarians (AAWV) as susceptible to and carriers of disease and parasites. Because of the potential threat to free-ranging waterfowl, the AAWV put forth the following resolution (AAWV, undated):

> ...wild and semi-domestic ducks, geese and swans are susceptible to and carriers of disease and parasites of free-ranging wild ducks, geese, and other birds;..."
>
> ...the AAWV encourages local authorities and state and federal agencies to cooperate to limit the population of waterfowl on urban water areas to prevent disease outbreaks in semidomestic as well as freeranging ducks, geese and swans and discourages the practice of relocating nuisance or excess urban ducks, geese and swans to other parks or wildlife areas as a means of local population control."

Some of the species listed as threatened or endangered under the Endangered Species Act of 1973 are preyed upon or otherwise adversely affected by certain bird species. For instance, brood parasitism by brown-headed cowbirds has become a concern for many wildlife professionals where these birds are plentiful. Inter-specific nest competition has been well documented in brown-headed cowbirds. The brown-headed cowbird may function most prominently in negatively impacting other bird species. These birds successfully parasitize the nests of songbirds laying 1 or sometimes 2 eggs per host nest and laying up to 25 or more eggs per nesting season (Dolbeer 1994). The brownheaded cowbird is a species that is known to parasitize the nests of at least 158 avian species (Friedman 1929) and is thought to be responsible for the decline in populations of many species of resident and migrant birds. With endangered bird species, such parasitism may cause enough nest failures to jeopardize the host species.

Indiana is the host for the easternmost nesting colony of the endangered Interior least tern. American crows, gulls, and Great blue herons have played a significant role in the decimation of the eggs and nestlings (Mills 2001). WS has been working to reduce these threats through technical assistance and direct control. Such activities include the recommendation to modify habitat, establishment of barriers, taste repellents, and use of harassment techniques.

1.3.4 Need for Bird Damage Management to Protect Human Health and Safety

Birds pose risks to human health and safety when their populations reach relatively high numbers or when concentrated in a localized area. These risks include but are not limited to items such as transmission of diseases to workers and the public, contamination of consumable items such as food products and pharmaceuticals. Accumulations of bird droppings have also caused injuries due to slipping on sidewalks, catwalks, and pedestrian areas.

1.3.4.1 Bird Damage Management to Protect Human Health and Safety

Birds play an important role in the transmission of zoonotic diseases to humans such as Encephalitis, West Nile Virus, Psittacosis, and Histoplasmosis. Public health officials and residents at such sites express concerns for human health related to the potential for disease transmission where dropping deposits accumulate. Some bird species form large communal roosts of the kind associated with disease organisms which grow in soils enriched by bird excrement, such as *Histoplasma capsulatum* (Weeks and Stickley 1984). Sometimes, such roosts occur in urban environments.

Feral domestic pigeons and starlings have been suspected in the transmission of 29 different diseases to humans, (Rid-A-Bird 1978, Weber 1979, and Davis et.al. 1971). These include viral diseases such as meningitis and seven different forms of encephalitis; bacterial diseases such as erysipeloid, salmonellosis, paratyphoid, pasteurellosis, and listeriosis; mycotic (fungal) diseases such as aspergillosis, blastomycosis, candidiasis, cryptococcosis, histoplasmosis, and sarcosporidiosis; protozoal diseases such as American trypansomiasis and toxoplasmosis; and

rickettsial/chlamydial diseases such as chlamydiosis and Q fever. As many as 65 different diseases transmittable to humans or domestic animals have been associated with pigeons, starlings, and English sparrows (Weber 1979). Table 1-1 shows the more typical diseases affecting humans that can be transmitted by pigeons and starlings.

Table 1-1. Information on some diseases transmittable to humans and livestock that are associated with feral domestic pigeons, starlings, and English sparrows--Information taken from Weber (1979)

Disease	Human Symptoms	Potential for Human Fatality	Effects on Domestic Animals
Bacterial:			
Erysipeloid	Skin eruption with pain, itching; headaches, chills, joint pain, prostration, fever, vomiting	Sometimes-particularly in young children, old or infirm people	Serious hazard for the swine industry
Salmonellosis	Gastroenteritis, septicaemia, persistent infection	Possible, especially in individuals weakened by other disease or old age	Causes abortions in mature cattle, possible mortality in calves, decrease in milk production in dairy cattle
Pasteurellosis	Respiratory infection, nasal discharge, conjunctivitis, bronchitis, pneumonia, appendicitis, urinary bladder inflammation, abscessed wound infections	Rarely	May fatally affect chickens, turkeys, and other fowl
Listeriosis	Conjunctivitis, skin infections, meningitis in newborns, abortions, premature delivery, stillbirth	Sometimes-particularly with newborns	In cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles
Viral:			
Meningitis	Inflammation of membranes, covering the brain, dizziness, and nervous movements	Possible-can also result as a secondary infection with listeriosis, salmonellosis, cryptococcosis	Causes middle ear infection in swine, dogs, and cats
Encephalitis (7 forms)	Headache, fever, stiff neck, vomiting, nausea, drowsiness, disorientation	Mortality rate for eastern equine encephalomyelitis may be around 60%	May cause mental retardation, convulsions, and paralysis
Mycotic (fungal):			
Aspergillosis	Affects lungs and broken skin, toxins poison blood, nerves, and body cells	Not usually	Causes abortions in cattle
Blastomycosis	Weight loss, fever, cough, bloody sputum and chest pains	Rarely	Affects horses, dogs, and cats
Candidiasis	Infection of skin, fingernails, mouth,	Rarely	Causes mastitis, diarrhea, vaginal discharge and

		respiratory system, intestines, and urogenital tract		aborted fetuses in cattle
	Cryptococcosis	Lung infection, cough, chest pain, weight loss, fever or dizziness, also causes meningitis	Possible especially with meningitis	Chronic mastitis in cattle, decreased milk flow, and appetite loss
	Histoplasmosis	Pulmonary or respiratory disease; may affect vision	Possible, especially in infants and young children or if disease disseminates to the blood and bone marrow	Actively grows and multiplies in soil and remains active long after birds have departed
Protozoal:				
	American trypanosomiasis	Infection of mucous membranes of eyes or nose, swelling	Possible death in 2-4 weeks	Caused by the conenose bug found in pigeons
	Toxoplasmosis	Inflammation of the retina, headaches, fever, drowsiness, pneumonia, strabismus, blindness, hydrocephalus, epilepsy, and deafness	Possible	May cause abortion or still birth in humans, mental retardation
Rickettsial/Chlamydial:				
	Chlamydiosis	Pneumonia, flu-like respiratory infection, high fever, chills, loss of appetite, cough, severe headaches, generalized aches and pains, vomiting, diarrhea, hepatitis, insomnia, restlessness, low pulse rate	Occasionally, restricted to old, weak or those with concurrent diseases	In cattle, may result in abortion, arthritis, conjunctivitis, and enteritis
	Q fever	Sudden pneumonitis, chills, fever, weakness, sever sweating, chest pain, severe headaches, and sore eyes	Possible	May cause abortions in sheep and goats

Resident Canada goose conflicts may potentially impact human health. A foraging Canada goose defecates between 5.2 and 8.8 times per hour (Bedard and Gauthier 1986). Kear (1963 In Allan et al. 1995) recorded a maximum fecal deposition rate for Canada geese of 0.39 pounds per day (dry weight). Public swimming beaches, private ponds, and lakes have been affected by goose droppings. There are several pathogens involving waterfowl which may be contracted by humans, however, the risk of infection is believed low.

Cryptosporidiosis is a disease caused by the parasite *Cryptosporidium parvum* and was not known to cause disease in humans until as late as 1976 (Centers for Disease Control and Prevention (CDCP) 1998). A person can be infected by drinking contaminated water or direct contact with the droppings of infected animals (CDCP 1998). The public is advised to be careful when

swimming in lakes, ponds, streams, and pools, and to avoid swallowing water while swimming (Colley 1996). The public is also advised to avoid touching stools of animals and to drink only safe water (Colley 1996). *Cryptosporidium* can cause gastrointestinal disorders (Virginia Department of Health 1995) and produce lifethreatening infections in immunocompromised and immunosuppressed people (Roffe 1987, Graczyk et al. 1998). Cryptosporidiosis is recognized as a disease with implications for human health (Smith et al. 1997). Canada geese in Maryland were shown with molecular techniques to disseminate infectious *Cryptosporidium parvum* oocysts through mechanical means in the environment (Graczyk et al. 1998). Giardiasis (*Giardia lambia)* is an illness caused by a microscopic parasite that has become recognized as one of the most common causes of waterborne disease in humans in the United States during the last 15 years (CDCP 1999). Giardiasis is contracted by swallowing contaminated water or putting anything in your mouth that has touched the stool of an infected animal or person, and causes diarrhea, cramps and nausea (CDCP 1999). Canada geese in Maryland were shown with molecular techniques to disseminate infectious Giardia sp. cysts in the environment (Graczyk et al. 1998).

Salmonella *(Salmonella spp.)* may be contracted by humans by handling materials soiled with bird feces (Stroud and Friend 1987). Salmonella causes gastrointestinal illness, including diarrhea.

Chlamydia psittaci, which can be present in diarrhetic feces of infected waterfowl, can be transmitted if it becomes airborne (Locke 1987). Severe cases of Chlamydiosis have occurred among wildlife biologists and others handling snow geese, ducks, and other birds (Wobeser and Brand 1982). Chlamydiosis can be fatal to humans if not treated with antibiotics. Waterfowl, herons, and rock doves (pigeons) are the most commonly infected wild birds in North America (Locke 1987).

Escherichia coli (*E. coli*) are fecal coliform bacteria associated with fecal material of warm blooded animals. There are over 200 specific serological types of E. coli and the majority are harmless (Sterritt and Lester 1988). Probably the best known serological type of *E. coli* is *E. coli* O157:H7, which is a harmful *E. coli* usually associated with cattle (Gallien and Hartung 1994). This was the rationale for testing public water supplies that was developed in the United States and Europe at the turn of the century to reduce the incidence of waterborne diseases.

Regardless of whether the serological types of *E. coli* disseminated into watersheds by geese are proven to be harmful to humans, it has been demonstrated that Canada geese can disseminate *E. coli* into the environment and result in elevated fecal coliform densities in the water column (Hussong et al. 1979). Many communities monitor water quality at swimming beaches, but lack the financial resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards the beaches are temporarily closed adversely affecting the human quality of life, even though they may not have been able to determine the serological type of the *E. coli*. Unfortunately, linking the elevated bacterial counts to frequency of waterfowl use and attributing the elevated levels to human health threats has been problematic until recently. Advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link these animal sources of coliform bacteria to fecal contamination (Jamieson 1998, Simmons et al. 1995). Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. Microbiologists were able to implicate waterfowl and gulls as the source of fecal coliform bacteria at the Kensico Watershed, a water supply for New York City (Klett et al. 1998). Also, fecal coliform bacteria counts coincided with the number of Canada geese and gulls roosting at the reservoir.

Roscoe (1999) conducted a survey to estimate the prevalence of pathogenic bacteria and protozoa in resident Canada geese in NJ, and found no *Salmonella* sp., *Shigella* sp., or *Yersinia* sp. Isolated from any of the 500 Canada goose samples. However, he did report finding *Cryptosporidium* sp. in 49 (10%) of the 500 geese, and *Giardia* sp. in 75 (15%) of the geese. Additionally, the USGS (U.S. Geological Survey 2000) conducted field studies in NJ, VA, and MA to determine the

presence of organisms that could cause disease in human exposed to feces of Canada geese at sites with a history of high public use and daily use by geese. *Salmonella spp.*, *Listeria spp.*, *Chlamydia sp.*, and *Giardia spp*. were isolated from goose feces in New Jersey (U.S. Geological Survey 2000).

While transmission of disease or parasites from geese to humans has not been well documented, the potential exists (Luechtefeld et al. 1980,Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blandespoor and Reimink 1991, Graczyk et al. 1997, Saltoun, et al. 2000). In worst case scenarios, infections may even be life threatening for immunocompromised and immunosuppressed people (Roffe 1987, Virginia Department of Health 1995, Graczyk et al. 1998). Even though many people are concerned about disease transmission from feces, the probability of contracting disease from feces is believed to be small. WS recognizes and defers to the authority and expertise of local and state health officials in determining what does or does not constitute a threat to public health.

Pharmaceutical purity, food wholesomeness and safety can be affected by contamination from bird droppings and debris during the manufacturing, packaging, distribution, and storage processes. In 1998, an Indiana pharmaceutical company sustained $165,000 in product loss when a single bird feather was discovered in a vat of pharmaceutical products (Loven 1998, personal communication).

Research has shown that gulls carry various species of bacteria such as *Bacillus* sp., *Clostridium* sp., *Campylobacter* spp., *Escherichia coli*, *Listeria* spp., and *Salmonella* spp. (MacDonald and Brown 1974, Fenlon 1981, Butterfield et al. 1983, Monaghan et al. 1985, Norton 1986, Vauk-Hentzelt et al. 1987, Quessey and Messier 1992). Transmission of bacteria from gulls to humans is difficult to document, however, Reilley et al. (1981) and Monaghan et al. (1985) both suggested that gulls were the source of contamination for cases of human salmonellosis. Concentrations of gulls at municipal water supply sources and waste water and sewage treatment facilities may also contribute to disease transmission (Jones et al. 1978, Hatch 1996).

Public health concerns often arise when gulls feed and loaf near fast food restaurants, and picnic facilities; deposit waste from landfills in urban areas; and contaminate industrial facility ventilation systems with feathers, nesting debris, and droppings. Gulls feeding on vegetable crops and livestock feed can potentially aid in the transmission of salmonella.

Large flocks of birds pose such a risk to aircraft and the health and safety of pilots that flight hours have been restricted during peak bird activity. Lands adjacent to airports can be hosts or reservoirs for birds that may affect public health and safety at neighboring airports. WS potentially may conduct bird damage management projects on these adjoining properties for the protection of the aviation industry (USDA 2002). Birds of prey (raptors), such as owls, hawks, falcons, eagles, osprey, and vultures, are hazards to human safety and aircraft operations at airports because of their size, hunting behavior, and hovering/soaring habits (Blokpoel 1976). In spite of the large size and loud noise of incoming and departing aircraft, raptors are generally hesitant to yield aerial territory and therefore are frequently struck (Blokpoel 1976). The combination of abundant food sources, open space, and numerous perching structures on airport grounds and near runway/taxiway areas provides ideal hunting opportunities for many raptors (Blokpoel 1976). In addition to actual bird-aircraft collisions, many raptors are killed by the jet wash associated with large jet aircraft.

1.4 Current and Projected Work

A variety of services have been and are currently being provided by WS to reduce bird hazards at municipalities, industrial sites, agricultural sites, and private land within Indiana. These services include technical assistance, wildlife hazard assessments, wildlife hazard management plans, and direct assistance.

WS has conducted BDM projects that provide both Operational and Technical Assistance (TA) at municipalities, industrial sites, agricultural sites, and private land within Indiana. Such projects have included but are not limited to:

- the problems of European starlings (*Sturnus vulgarus)* and American crows (*Corvus brachyrhynchos)* roosting on the property posing serious risk to human health and safety,
- aggressive waterfowl towards humans during nesting season.
- nuisance Canada goose activity on golf course greens, fairways, ponds, and associated recreational areas.
- European starling activities damaging structures and causing potential human health and safety risks on industrial properties.
- livestock feed consumption and contamination from European starlings.

WS currently conducts BDM programs at airports in Indiana (USDA 2002). Direct assistance services currently involve one full time WS wildlife biologist to implement the current wildlife hazard management plan at an airport in Indiana. Other airports have contracted with WS to provide technical assistance on a part time basis. Projected work at Indiana airports include conducting wildlife hazard assessments, developing wildlife hazard management plans, providing technical assistance, and conducting direct control services. Examples of different work that has been conducted are: facilitating required permits, recommendations to modify habitat through vegetation management programs, converting croplands on airfields to a monoculture of turf grass, constructing wildlife fences, landscape and architectural consulting, testing new vegetation and perch barrier strategies, and direct control activities. Direct control activities include but are not limited to harassment, capture and relocation programs, and lethal removal.

Requests for WS BDM services similar to those described above are anticipated to continue throughout the state.

1.5 Relationship of the Environmental Assessment to other Environmental Documents

APHIS ADC (Animal Damage Control) Programmatic EIS. WS has issued a Final Environmental Impact Statement (FEIS) on the national APHIS/WS program (USDA 1997). This EA is tiered to the Final EIS. Pertinent information available in the FEIS has been incorporated by reference into this EA.

APHIS Wildlife Services Wildlife Damage Management at Airports in Indiana EA. WS has completed an EA and FONSI on the WS airport wildlife damage management program in Indiana (USDA 2002). This EA includes information about bird species that may impact property and human health and safety at airports. Pertinent information available in the EA has been incorporated by reference into this EA.

1.6 Decision to be Made

Based on the scope of this EA, the decisions to be made are:

- Should the IBDM strategy implemented by the WS program be continued in Indiana?
- If not, should WS attempt to implement any of the alternatives to an IBDM strategy as described in the EA?
- Might the implementation of a WS's program of BDM have significant impacts requiring preparation of an EIS?

1.7 Scope Of This Environmental Assessment Analysis

1.7.1 Actions Analyzed This EA evaluates bird damage management by WS to protect property, agriculture, natural resources, and human health and safety at municipalities, industrial sites, agricultural sites, and private land within Indiana wherever such management from the WS program is requested.

1.7.2 Period for Which this EA is Valid This EA will remain valid until WS determines that new needs

for action or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and revised as necessary. This EA will be reviewed each year to ensure that it is complete and still appropriate to the scope of WS's BDM activities.

1.7.3 Site Specificity. This EA analyzes potential impacts of WS's BDM activities that will occur or could occur in municipalities, industrial sites, agricultural sites, and private land within Indiana. This EA analyzes the potential impacts of such efforts wherever and whenever they might occur. The EA emphasizes significant issues as they relate to specific areas whenever possible. However, the issues that pertain to the various types of bird damage and resulting management are the same, for the most part, wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) and WS Directive 2.105 is the routine thought process that is the site-specific procedure for determining methods and strategies to use or recommend for individual actions conducted by WS on the aforementioned sites (See USDA 1997, Chapter 2 and Appendix N for a more complete description of the WS Decision Model and examples of its application). Decisions made using this thought process will be in accordance with any mitigation measures and standard operating procedures described herein and adopted or established as part of the decision.

1.8 Authority and Compliance

1.8.1 Authority of Federal and State Agencies in Bird Damage Management at Municipalities, Industrial sites, Agricultural sites, and Private land within Indiana

1.8.1.1 WS Legislative Authority

The primary statutory authority for the Wildlife Services program is the Act of March 2, 1931, as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

> *"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."*

Since 1931, with the changes in societal values, WS policies and programs place greater emphasis on the part of the Act discussing "bringing (damage) under control," rather than "eradication" and "suppression" of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

> *"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."*

1.8.1.2 U.S. Fish and Wildlife Service (USFWS)

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the Migratory Bird Treaty Act and those that are listed as threatened or endangered under the Endangered Species Act. Sections 1.8.2.2 and 1.8.2.3 below describe WS's interactions with the USFWS

under these two laws.

1.8.1.3 Indiana Department of Natural Resources Legislative Authority

The Indiana Department of Natural Resources (IDNR), under the direction of the Conservation Commission, is specifically charged by the General Assembly with the management of the state's wildlife resources. The primary statutory authorities include the protection, reproduction, care, management, survival, and regulation of wild animal populations regardless of whether the wild animals are present on public or private property in Indiana (IC 14-22-2-3). The Division of Fish and Wildlife shall administer this article.

1.8.2 Compliance with other Federal Laws

Several other federal laws authorize, regulate, or otherwise affect WS bird damage management. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.8.2.1 National Environmental Policy Act (NEPA)

WS prepares analyses of the environmental impacts of program activities to meet procedural requirements of this law. This EA meets the NEPA requirement for the proposed action at municipalities, industrial sites, agricultural sites, and private land within Indiana. When WS operational assistance is requested by another federal agency, NEPA compliance is the responsibility of the other federal agency. However, WS may agree to complete NEPA documentation at the request of the other federal agency.

1.8.2.2 Endangered Species Act (ESA)

It is federal policy, under the ESA, that all federal agencies shall seek to conserve threatened and endangered (T&E) species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the U.S. Fish & Wildlife Service (USFWS) to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available" (Sec.7(a)(2)). WS obtained a Biological Opinion (B.O.) from USFWS in 1992 describing potential effects on T & E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F).

1.8.2.3 Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711; 40 Stat. 755), as amended.

The Migratory Bird Treaty Act (MBTA) provides the USFWS regulatory authority to protect families of birds that contain species that migrate outside the United States. The law prohibits any "take" of these species, except as permitted by the USFWS; therefore the USFWS issues permits for reducing bird damage. WS will obtain MBTA permits covering WDM activities that involve the taking of species for which such permits are required in accordance with the MBTA and USFWS regulations, or will operate as a named agent on MBTA permits obtained by cooperators. WS is also authorized by the IDNR covering the intentional take migratory birds for damage management purposes from the IDNR Wildlife Code which regulates take of migratory birds protected by state law.

1.8.2.4 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods used or recommended by the WS program at the aforementioned sites in Indiana are registered with and regulated by the EPA and Indiana, and are used by WS in compliance with labeling procedures and requirements.

1.8.2.5 National Historic Preservation Act (NHPA) of 1966 as amended

The National Historic Preservation Act (NHPA) of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. WS has determined BM actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties.

1.8.2.6 Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360). This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

1.8.2.7 Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.). This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that are used in wildlife capture and handling.

1.8.2.8 Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA). The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs. Those requirements are: (1) a valid “veterinarian-client-patient” relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified; the Western Wildlife Health Committee of the Western Association of Fish and Wildlife Agencies has recommended that suitable identification markers include durable ear tags, neck collars, or other external markers that provide unique identification (WWHC *undated*). APHIS-WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

1.8.2.9 Environmental Justice and Executive Order 12898 - "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations."

Executive Order 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. It is a priority within APHIS and WS. Executive Order 12898 requires Federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated

that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

1.8.2.10 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

Children may suffer disproportionately from environmental health and safety risks for many reasons. Bird damage management as proposed in this EA would only involve legally available and approved damage management methods in situations or under circumstances where it is highly unlikely that children would be adversely affected. Therefore, implementation of the proposed action would not increase environmental health or safety risks to children.

1.8.2.11 Executive Order 13112 - Invasive Species

Executive Order 13112 directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health.

1.8.2.12 Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29CFR1910) on sanitation standards states that “Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected.” This standard includes birds that may cause safety and health concerns at workplaces.

1.8.3 Compliance with other State and Federal Laws

1.8.3.1 Owner May Protect Property 3CSR10-4.130

This regulation authorizes landowners or agents of the landowner to protect property, subject to federal regulations from migratory birds, any wildlife except deer, turkey, and any endangered species which beyond reasonable doubt is damaging property may be capture or killed at any time with out a permit. Deer, turkey, and endangered species that are causing damage maybe killed only with the permission of an agent of the department, and by methods authorized by the agent.

2.0 CHAPTER 2 - ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of mitigation measures and/or standard operating procedures, and issues that will not be considered in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional description of affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4.

Affected Environment

The affected areas potentially include all municipal sites, industrial sites, agricultural sites, and private land within Indiana. Most of these properties in the state of Indiana contain similar types of habitat such as woodlands, wetlands, grasslands, croplands, and suburban areas. Thus, these sites may deal with similar types of problems caused by wildlife. WS could be called upon to conduct BDM on any of these sites in Indiana, including any adjacent properties that are negatively impacting or have the potential to negatively impact such properties. Any adjacent properties would be dealt with under a separate agreement.

2.1 Issues. The following issues have been identified as areas of concern requiring consideration in this EA. These will be analyzed in detail in Chapter 4:

Effects on Target Bird Species Populations
Effects on Non-target Species Populations, including T&E Species
Economic Losses to Property as a Result of Bird Damage
Effects on Human Health and Safety
Effects on Aesthetics
Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS

2.2 Issues Addressed in the Analysis of Alternatives

2.2.1 Effects on Target Bird Species Populations

A common concern among members of the public is whether bird damage management actions adversely affect the viability of target species populations. The target species selected for analysis in this EA are the bird species listed in section 1.2. A minimal number of individuals are likely to be killed by WS's use of lethal control methods under the proposed action in any one year.

2.2.2 Effects on Non-target Species populations, including T&E Species

A common concern among members of the public and wildlife professionals, including WS personnel, is the impact of damage control methods and activities on non-target species, particularly Threatened and Endangered Species. WS's standard operating procedures include measures intended to mitigate or reduce the effects on non-target species populations and are presented in Chapter 3.

Special efforts are made to avoid jeopardizing Threatened and Endangered Species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted with the USFWS under Section 7 of the Endangered Species Act (ESA) concerning potential impacts of BDM methods on T&E species and has obtained a Biological Opinion (B.O.). For the full context of the B.O., see Appendix F of the ADC FEIS (USDA 1997, Appendix F). WS is also in the process of reinitiating Section 7 consultation at the program level to assure that potential effects on T&E species have been adequately addressed.

2.2.3 Economic Losses to Property as a Result of Bird Damage

A major concern by many property owners is the economic impact of bird damage to that property. These people are concerned as to whether the proposed action or any of the alternatives would reduce such damage to more acceptable levels. Birds have and could cause damage to property as described in the need for action.

2.2.4 Effects on Human Health and Safety

2.2.4.1 Safety and efficacy of chemical control methods

Some individuals may have concerns that chemicals used for animal control should not be used because of potential adverse effects on people from being exposed to the chemicals directly or to the animals that have died as a result of the chemical use. Under the alternatives proposed in this EA, one of the toxicants proposed for use by WS is DRC-1339 (Starlicide), which would be primarily used to remove feral domestic pigeons and starlings or blackbirds in damage situations. The EPA through FIFRA regulates DRC-1339 use, by Indiana Pesticide Control Laws, and by WS Directives. The chemical bird repellents methyl anthranilate (Rejex-it, Goose Chase, etc.) or anthraquinone (Flight Control) could be used to reduce feeding activity on the airfield. Both methyl anthranilate and anthraquinone are non-lethal and work by causing a negative response to feeding in the treated area. Another chemical method that could be used is Avitrol, which is classified as a chemical frightening agent and is normally used to avert certain bird species from using certain problem areas. The avian tranquilizer Alpha-Chloralose could be used for live-capturing nuisance waterfowl.

Other individuals may have concerns that there is a potential for drugs used in animal capture, handling, and euthanasia to cause adverse health effects in humans that hunt and eat the species involved. Among the species to be captured and handled under the proposed action, this issue is expected to only be of concern for birds which are hunted and sometimes consumed by people as food. Drugs used in capturing, handling, and euthanizing birds for bird hazard management purposes include Alpha Chloralose and DRC-1339. Meeting the requirements of the AMDUCA (see section 1.8.2.8) should prevent any significant adverse impacts on human health with regard to this issue. Mitigation measures that would be part of the standard operating procedures include:

- All drug use in capturing and handling birds would be under the approval of state veterinary authorities, through procedures agreed upon between those authorities and APHIS-WS. As determined on a state-level basis by these veterinary authorities (as allowed by AMDUCA), bird hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used.
- Most animals administered drugs would be released well before state controlled hunting/trapping seasons which would give the drug time to completely metabolize out of the animals' systems before they might be taken and consumed by humans. In some instances, animals collected for control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting or trapping season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

By following these procedures in accordance with AMDUCA, bird hazard management programs would avoid any significant impacts on human health with regard to this issue.

2.2.4.2 Impacts on human safety of non-chemical BDM methods

Some people may be concerned that WS's use of firearms, traps, and pyrotechnic scaring devices could cause injuries to people. WS personnel occasionally use traps, rifles, and shotguns to remove birds that are causing damage. There is some potential fire hazard to agricultural sites and private property from pyrotechnic use.

2.2.4.3 Impacts on human safety from birds

The concern stated here is that the absence of adequate BDM would result in adverse effects on human health and safety, because bird damage would not be curtailed or reduced to the minimum levels possible and practical. The potential impacts of not conducting such work could lead to increased incidence of injuries, illness, or loss of human lives.

2.2.5 Effects on Aesthetics

2.2.5.1 Effects on Human Affectionate-Bonds with Individual animals and on Aesthetic Values of Bird Species

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and today a large percentage of households have pets. However, some people may consider individual birds as “pets” or exhibit affection toward these animals, especially people who enjoy coming in contact with birds. Therefore, the public reaction is variable and mixed to bird damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and birds.

Some individual members or groups of bird species habituate and learn to live in close proximity to humans. Some people in these situations feed such birds and/or otherwise develop emotional attitudes toward such animals that result in aesthetic enjoyment. In addition, some people consider individual birds as "pets," or exhibit affection toward these animals. Examples would be people who visit a city park to feed waterfowl or pigeons and homeowners who have bird feeders or birdhouses. Many people do not develop emotional bonds with individual birds, but experience aesthetic enjoyment from observing them.

There is some concern that the proposed action or the alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics are truly subjective in nature, dependent on what an observer regards as beautiful.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., bird-related recreation, observation, harvest, sale); indirect benefits derived from vicarious bird related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing birds exist and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user’s personal relationship to animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive

use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Public reaction to damage management actions is variable because individual members of the public can have widely different attitudes toward birds. Some individuals that are negatively affected by birds support removal or relocation of damaging birds. Other individuals affected by the same bird species may oppose removal or relocation. Individuals unaffected by bird damage may be supportive, neutral, or opposed to bird removal depending on their individual personal views and attitudes.

The public's ability to view birds in a particular area would be more limited if the birds are removed or relocated. However, immigration of birds from other areas could possibly replace the animals removed or relocated during a damage management action. In addition, the opportunity to view or feed other birds would be available if an individual makes the effort to visit local bird management areas and other sites with adequate habitat and local populations of the species of interest.

Some people do not believe that individual animals or nuisance bird roosts should even be harassed to stop or reduce damage problems. Some of them are concerned that their ability to view birds are lessened by WS non-lethal harassment efforts.

Indiana WS recognizes that all birds have aesthetic value and benefit. WS only conducts bird damage management at the request of the affected property owner or resource manager. If WS received requests from an individual or official for bird damage management, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane, and professional manner.

2.2.5.2 Effects on Aesthetic Values of Property Damaged by Birds

Property managers have expressed concerns of bird roosting in trees and structures and are generally concerned about the negative aesthetic appearance of bird droppings. Costs associated with property damage include labor and disinfectants to clean/sanitize fecal droppings, implementation of non-lethal bird management methods, loss of property use, loss of aesthetic value of flowers, gardens, and lawns where birds are roosting, or visitors irritated by the odor of or of having to walk on fecal droppings.

2.2.6 Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS.

The issue of humaneness and animal welfare, as it relates to the killing or capturing of bird species is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if " . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."

Suffering is described as a " . . . highly unpleasant emotional response usually associated with pain and distress." However, suffering " . . . can occur without pain . . ." and " . . . pain can occur without suffering . . . " (AVMA 1987). Because suffering carries with it the implication of a time frame, a case could be made for " . . . little or no suffering where death comes immediately . . . " (CDFG 1991), such as shooting.

Defining pain as a component in humaneness of WS methods appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would " . . . probably be causes for pain in other animals . . . " (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991).

Pain and suffering, as it relates to WS damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since " . . . neither medical or veterinary curricula explicitly address suffering or its relief" (CDFG 1991).

Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management techniques through research and development. The addition of approved chemical capture/euthanasia procedures has allowed WS personnel to meet veterinary humane criteria. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some BDM mechanical methods are used in situations where non-lethal damage management methods are not practical or effective.

Indiana WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures/Standard Operating Procedures (SOP) used to maximize humaneness are listed in Chapter 3.

3.0 CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter consists of 6 parts: 1) an introduction, 2) description of alternatives considered and analyzed in detail including the Proposed Action/No Action (Alternative 1), 3) a description of Integrated Bird Damage Management, 4) Bird damage management methods available for use or recommendation by WS in Indiana, 5) Alternatives considered but not in detail, with rationale, and 6) Mitigation measures and Standard Operating Procedures (SOPs) for bird damage management.

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), "*Methods of Control*" (USDA 1997 Appendix J) and the "*Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program"* (USDA 1997, Appendix P) of USDA (1997).

Alternatives analyzed in detail are:

Alternative 1 – Implement a Federal BDM Program /Integrated Bird Damage Management. This is the Proposed Action and No Action Alternative.
Alternative 2 - Non-lethal BDM only by WS.
Alternative 3 - Lethal BDM only by WS.
Alternative 4 - No Federal WS BDM.

3.1 DESCRIPTION OF THE ALTERNATIVES

3.1.1 Alternative 1 – Implement a Federal BDM Program /Integrated Bird Damage Management (Proposed Action/No Action).

The proposed action is to continue the current WS program that respond to requests for BDM at municipalities, industrial sites, agricultural sites, and private land within Indiana to protect property, agriculture, natural resources, and human health and safety at these locations. An Integrated Bird Damage Management (IBDM) approach would be implemented which would allow use of any legal technique or method, used singly or in combination, to meet request or needs for resolving conflicts with birds affecting the aforementioned properties (Appendix B). Those requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Lethal methods used or recommended by WS may include shooting, trapping, toxicants, or euthanasia following live capture by immobilization drugs or trapping. Non-lethal methods used or recommended by WS may include habitat alteration, chemical immobilization, repellents, fencing, barriers and deterrents, netting, capture and relocation, and harassment or scaring devices. In many situations, the implementation of non-lethal methods such as habitat alteration, structural modifications, and exclusion-type barriers would be the responsibility of the property managers to implement. BDM by WS would be allowed on the aforementioned sites, when requested, where a need has been documented and upon completion of an Agreement for Control. All management actions would comply with appropriate federal, state, and local laws.

3.1.2 Alternative 2 - Non-lethal BDM Only, By WS.

This alternative would require WS to use and recommend non-lethal methods only to resolve bird damage problems. Requests for information regarding lethal management approaches would be referred to IDNR, FWS, local animal control agencies, or private businesses or organizations. Individuals might choose to implement WS non-lethal recommendations, implement lethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, or take no

action. Currently, DRC-1339 and Alpha-Chloralose are only available for use by WS employees. DEA regulated immobilizing/euthanasia drugs are available only to licensed veterinarians or other authorized users such WS personnel. Therefore, use of these chemicals by private individuals would be illegal. Under this alternative, Alpha-Chloralose or other approved capture drugs would be used by WS personnel to capture and relocate birds. Appendix B describes a number of non-lethal methods available for use by WS under this alternative.

3.1.3 Alternative 3 - Lethal BDM Only, By WS.

Under this alternative, WS would provide only lethal direct control services and technical assistance. Technical assistance would include making recommendations to the FWS and IDNR regarding the issuance of permits to resource owners to allow them to take birds by lethal methods. Requests for information regarding non-lethal management approaches would be referred to IDNR, FWS, local animal control agencies, or private businesses or organizations. Individuals might choose to implement WS lethal recommendations, implement non-lethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary. Appendix B describes a number of lethal methods available for use by WS under this alternative.

3.1.4 Alternative 4 - No Federal WS BDM.

This alternative would eliminate Federal WS involvement in BDM at municipalities, industrial sites, agricultural sites, and private land within Indiana. WS would not provide direct operational or technical assistance and requesters of WS services would have to conduct their own BDM without WS input. Requests for information would be referred to IDNR, FWS, local animal control agencies, or private businesses or organizations. Individuals might choose to conduct BDM themselves, use contractual services of private businesses, or take no action. DRC-1339 and Alpha-Chloralose are only available for use by WS employees. Therefore, use of these chemicals as well as DEA controlled substances by private individuals would be illegal.

3.2 BDM Strategies and Methodologies Available to WS at Municipalities, Industrial sites, Agricultural Sites, and Private land within Indiana.

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2, and 3 described above. Alternative 4 would terminate both WS technical assistance and operational BDM by WS. Appendix B is a more thorough description of the methods that could be used or recommended by WS.

3.2.1 Integrated Bird Damage Management (IBDM)

The most effective approach to resolving bird damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IBDM is to implement the best combination of effective management methods in a cost-effective[1] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IBDM may incorporate habitat modification (i.e., exclusion), bird behavior modification (i.e., scaring), removal of individual offending

[1] The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns

birds, local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

3.2.2.1 Technical Assistance Recommendations

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate bird damage management methods. The implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application.

Under APHIS NEPA Implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IBDM approach to resolving bird damage problems.

3.2.2.2 Direct Damage Management Assistance

This is the implementation or supervision of damage management activities by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone, and when Agreements for Control or other comparable instruments provide for WS direct damage management. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS personnel are often required to effectively resolve problems, especially if restricted use pesticides or controlled substances are necessary, or if the problem is complex.

3.2.2.3 Examples of WS Direct Operational and Technical Assistance in BDM at Municipalities, Industrial sites, Agricultural sites, and Private land within Indiana

WS has implemented and conducted several projects that provide both Operational and Technical Assistance (TA) at municipalities, industrial sites, agricultural sites, and private land within Indiana. Such projects include but are not limited to the problems of European starlings (*Sturnus vulgarus)* and American crows (*Corvus brachyrhynchos)* roosting on the property posing serious risk to human health and safety, and aggressive waterfowl towards humans during nesting season.

- WS has provided technical assistance and operational assistance to golf courses to reduce nuisance Canada goose activity on greens, fairways, ponds, and associated recreational areas. A combination of active harassment and habitat modification recommendations have been used to reduce the risk of bird damage.
- WS has provided technical assistance to industrial sites to reduce starling activities on industrial properties by providing information on habitat and behavior modification, and harassment using multiple techniques. WS has also provided direct control through harassment using exclusion methods, pyrotechnics, and lethal reinforcement by chemical control or precision sharp-shooting.
- WS has provided TA to Indiana agricultural sites to reduce livestock feed consumption

and contamination from European starlings. WS has recommended changes in husbandry, habitat, building modifications, and harassment techniques.

- WS's technical assistance activities in resolving bird damage have been 100% non-lethal. IBDM principles are implemented when WS is involved in direct control activities. For example, during the 1-year period of FY 2001, the number of mixed blackbird species causing damage at one Indiana industrial facility was estimated at approximately 60,000 birds. WS incorporated lethal control measures to reduce this local bird population by 13.6%. Control of the remaining 86.4% of these birds was achieved through non-lethal methods.

3.2.3 WS Decision-Making

WS personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model described by Slate et al. (1992) (Appendix C). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS personnel assess the problem and evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a documented process, but a mental problem-solving process common to most if not all professions.

3.2.4 Bird Damage Management Methods Available for Use. (See Appendix B for detailed descriptions of BDM Methodologies)

3.2.4.1 Non-chemical, Non-lethal Methods (See Appendix B for detailed descriptions)

Property owner practices consist primarily of non-lethal preventive methods such as cultural methods[2] and habitat modification.

Bird behavior modification refers to tactics that alter the behavior of birds to reduce damages. Some but not all of these tactics include:

- Exclusions such as netting
- Propane cannons (to scare birds)
- Pyrotechnics (to scare birds)
- Distress calls and sound producing devices (to scare birds)

[2] Generally involves modifications to the management of protected resources to reduce their vulnerability to wildlife damage

- Visual repellents and scaring tactics
- Lasers (to scare birds)
- Effigies (to scare birds from roost sites and loafing sites)

Relocation of damaging birds as directed by IDNR to other areas.

Nest destruction of the target species before eggs or young is in the nest.

Egg addling/destruction is the practice of destroying the embryo in the egg prior to hatching; physically breaking eggs; or directly removing eggs from a nest and destroying them.

Habitat/environmental modification to attract or repel certain bird species.

Live traps are various types of traps designed to capture birds alive for relocation or euthanasia. Some examples are cage traps, clover traps, decoy traps, nest box traps, mist nets, etc.

3.2.4.2 Chemical, Non-lethal Methods (See Appendix B for detailed descriptions)

Avitrol is a chemical frightening agent registered for use on pigeons, crows, gulls, blackbirds, starlings, and English sparrows in various situations. This chemical works by causing distress behavior in the birds that consume treated kernels from a mixture of treated and untreated bait, which generally frightens the other birds from the site. Generally birds that eat the treated bait will die (Johnson and Glahn 1994).

Alpha-chloralose is used as an immobilizing agent, which is a central nervous system depressant, and used to capture waterfowl or other birds. It is generally used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as a well-contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds.

Methyl Anthranilate (MA) (artificial grape flavoring food additive) has been shown to be an effective repellent for many bird species, including waterfowl. It can be applied to turf or surface water or as a fog to repel birds from small areas. It may also become available for use as a livestock feed additive that has bird repellent value.

Flight Control® (anthraquinone) (Avery et al. 1997) The chemical bird repellent Flight Control could be used to reduce feeding activity on the airfield. Flight Control® is a bio-pesticide that is non-lethal and works by causing a negative response to feeding in the treated area.

3.2.4.3 Mechanical, Lethal Methods (See Appendix B for detailed descriptions)

Shooting is the practice of selectively removing target species by shooting with an air rifle, shotgun, or rifle. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques.

Snap traps may be modified to remove individual birds such as woodpeckers.

Cervical dislocation is sometimes used to euthanize birds that are captured in live traps. AVMA approves this technique as humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry, and all small birds (Beaver et al. 2001).

Sport Hunting is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted, and activities can meet property security and safety compliance.

3.2.4.4 Chemical, Lethal Methods (See Appendix B for detailed descriptions)

DRC-1339 is a chemical for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds and mammals. This chemical would be the primary lethal chemical method used for feral domestic pigeon, starling, and blackbird damage management under the current program.

Carbon dioxide (CO_2) gas is an American Veterinary Medical Association (AVMA) approved euthanasia method (Beaver et al. 2001) which is sometimes used to euthanize birds which are captured in live traps or by chemical immobilization and when relocation is not a feasible option. Live birds are placed in a container or chamber into which CO_2 gas is released. The birds quickly expire after inhaling the gas.

3.3 Alternatives Considered But Not Analyzed in Detail with Rationale

3.3.1 Technical Assistance Only

This alternative would not allow WS operational BDM at municipalities, industrial sites, agricultural sites, and private land within Indiana. WS would only provide technical assistance and make recommendations when requested. This alternative has been determined ineffective based upon the unsuccessful attempts by property managers to conduct BDM prior to WS direct control involvement. The BDM programs implemented by property owners prior to WS involvement were unsuccessful in preventing the damage that prompted management to seek assistance by WS.

3.4 Mitigation and Standard Operating Procedures for Bird Damage Management Techniques

3.4.1 Mitigation in Standard Operating Procedures (SOP)

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Indiana uses many such mitigation measures and these are discussed in detail in Chapter 5 of the FEIS (USDA 1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS's Standard Operating Procedures include:

Mitigation Measures		**Alternatives**		
	1	2	3	4
Animal Welfare and Humaneness of Methods used by WS				
Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate	X	X	X	
The Decision Model (Slate et al. 1992) is used to identify effective biological and	X	X	X	

ecologically sound BDM strategies and their impacts.				
Captured non-target birds are released or relocated unless it is determined by the Indiana WS personnel that the bird would not survive	X	X	X	
The use of traps conform to current laws and regulations administered by IDNR and IN WS policy.	X	X	X	
Euthanasia procedures approved by the AVMA that cause minimal pain are used for live captured birds.	X		X	
Drugs are used according to the Drug Enforcement Agency, FDA, and WS program policies and directives and procedures are followed that minimizes pain.	X	X	X	
The use of newly developed, proven non-lethal methods would be encouraged when appropriate.	X	X		
Safety Concerns Regarding WS BDM Methods				
All pesticides are registered with the EPA and IDNR.	X	X	X	
WS employees would follow all EPA approved label directions.	X	X	X	
All controlled substances are registered with DEA or FDA.	X	X	X	
WS employees would follow approved procedures outlined WS Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson, et al. 2001).	X	X	X	
The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, is used to determine BDM strategies.	X	X	X	
WS employees that use pesticides are trained to use each material and are certified to use pesticides under EPA approved certification programs.	X	X	X	
WS employees that use controlled substances are trained to use each material and are certified to use controlled substances under Agency certification program.	X	X	X	
WS employees who use pesticides and controlled substances participate in State approved continuing education to keep abreast of developments and maintain their certifications.	X	X	X	

Pesticide and controlled substance use, storage, and disposal conform to label instruction and other applicable laws and regulations, and Executive Order 12898.	X	X	X	
Material Safety Data Sheets for pesticides and controlled substances are provided to all WS personnel involved with specific BDM activities.	X	X	X	
Concerns about Impacts of BDM on Target Species, Species of Special Concern, and Non-target Species				
WS consulted with the USFWS regarding the nation-wide program and would continue to implement all applicable measure identified by the USFWS to ensure protection of T &E species.	X	X	X	
Management actions would be directed toward localized populations or groups and/or individual offending birds.	X	X	X	
WS personnel are trained and experienced to select the most appropriate methods for taking targeted birds and excluding non-target species.	X	X	X	
WS would initiate informal consultation with the USFWS following any incidental take of T &E species.	X	X	X	
The presence of non-target species is monitored before using toxicants to control starlings, blackbirds, and pigeons to reduce the risk of significant mortality of non-target species populations.	X		X	
WS take is monitored by number of birds by species or species groups (i.e. blackbirds, raptors) with overall populations or trends in population to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations (See Chapter 4).	X		X	
WS uses chemical methods for BDM that have undergone rigorous research to prove their safety and lack of serious effects on non-target birds and the environment.	X	X	X	

4.0 CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. The chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis in Chapter 2. This section analyzes the environmental consequences of each alternative in comparison with the No Action alternative to determine if the real or potential impacts would be greater, lesser, or the same. Therefore, the proposed action alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The background and baseline information presented in the analysis of the current program alternative thus also applies to the analysis of each of the other alternatives. The No Action Alternative, as defined here, is consistent with the Council on Environmental Quality (CEQ) (1981).

The following resource values within the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

Cumulative Impacts: Discussed in relationship to each of the potentially affected species analyzed in this chapter.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

Impacts on sites or resources protected under the National Historic Preservation Act: WS BDM actions are not undertakings that could adversely affect historic resources (See Section 1.8.2.5).

4.1 Environmental Consequences for Issues Analyzed in Detail

4.1.1 Effects on Target Species Bird Populations

4.1.1.1 Alternative 1. - Implement a Federal Bird Damage Management/IBDM (Proposed Action/No Action)

Analysis of this issue is limited primarily to those species most often killed during WS IBDM. The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997). Magnitude is described in USDA (1997) as " . . . *a measure of the number of animals killed in relation to their abundance*." Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. Table 4-1 shows the numbers of birds killed by species and methods as a result of WS IBDM activities at municipal sites, industrial sites, agricultural sites, and private land within Indiana.

Table 4-1. Birds Lethally Removed by WS for Bird Damage Management in FY 2001 in Indiana

Species	Alpha Chloro-lose	DRC-1339	Other Trap	Shooting	Egg Destruction/ Nest Removal
Mixed Blackbird Species				12	
Red-winged Blackbird				2	
American Crow				2	
European Starling		8,185		9	
Mourning Dove				10	
Common Grackles				1	
Ringed-billed Gulls				4	
Great Blue Heron				2	
Killdeer				5	
Horned Larks				3	
Meadow Larks				6	
Mallards				8	
Pigeons				33	

Table 4-2 Number of Birds Harassed by WS for Bird Damage Management in FY 2001 in Indiana.

Species	**Dispersed/Freed**
Black Birds Mixed Species	14,327
Am. Crow	34
European Starling	12,425
Mourning dove	432
Mallards	166
Canada Geese	50
Grackles	29
Gulls	105
Upland Sandpipers	12
House Sparrow	26
Great Blue Herons	14
Hawks /Kestrels	63
Killdeer	55
Horned Lark	257
Purple Finch	10
Purple Martin	0
Meadow lark	145
Nighthawk	0
Owls	0
Pigeons	8
Am Robin	0

Swallows – Tree, barn, & cliff.	35
Turkey Vultures	10

Starling and Blackbird Population Impacts

Colonization of North America by the European Starling began on March 6, 1890 when a Mr. Eugene Scheifflin, a member of the Acclimatization Society, released 80 starlings into New York's Central Park. The birds thrived and exploited their new habitat. By 1918, the advance line of migrant juveniles extended from Ohio to Alabama; by 1926 from Illinois to Texas; by 1941 from Idaho to New Mexico; and by 1946 to California and Canadian coasts (Miller 1975). In just 50 short years the starling had colonized the United States and expanded into Canada and Mexico and 80 years after the initial introduction had become one of the most common birds in North America (Feare 1984).

Precise counts of blackbird and starling populations do not exist but one estimate placed the United States summer population of the blackbird group at over 1 billion (USDA 1997) and the winter population at 500 million (Royall 1977). The majority of these birds occur in the eastern U.S.; for example surveys in the southeastern part of the country estimated 350 million blackbirds and starlings in winter roosts (Bookhout and White 1981). Meanley and Royal (1976) estimated 538 million blackbirds and starlings in winter roosts across the country during the winter of 1974-75. The nationwide starling population has been estimated at 140 million (Johnson and Glahn 1994).

Breeding Bird Survey trend data from Sauer et al. (2001) indicate a slight annual decline (- 0.5%) in the starling breeding population in the mid-west U.S. from 1966–2000, and a slight annual decline (-0.5%) from 1980-2000. Breeding Bird Survey trend data for Indiana indicates starling populations were stable (-0.1% annually) from 1980-2000 (Sauer et al. 2001). Red-winged blackbird Breeding Bird Survey trend data showed a slight annual decline (-1.8%) and (-1.2%) from 1980-2000 for Indiana and the mid-west U.S., respectively (Sauer et al. 2001). Brown-headed cowbirds Breeding Bird Survey trend data showed a slight annual increase (1.6%) and a slight annual decline (-0.4%) from 1980-2000 for Indiana and the mid-west U.S., respectively (Sauer et al. 2001).

All of the above information indicates that populations of starlings and blackbirds have been relatively stable in recent years. For most species that show upward or downward trends, such trends have been relatively gradual. Additionally, blackbird populations are healthy enough, and the problems they cause great enough, that the USFWS has established a standing depredation order for use by the public. Under this "order" (50 CFR 21.43), no Federal permit is required by anyone to remove blackbirds if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance.

Between FY 1996 and FY 1998 States in the WS Eastern Region reported a combined average annual kill was 131,068 blackbirds and starlings (data from WS MIS system). No other sources of major human-caused blackbird and starling mortality are known.

Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997). Annual populations of the blackbird group in the eastern U.S. are at least 372 million, of which an estimated 140 million are starlings (Meanley and Royall 1976, Johnson and Glahn 1994). Therefore the estimated natural mortality of the blackbird group in the eastern U.S should be between 186 and 241 million birds annually. WS

kill of blackbirds and starlings at municipal sites, industrial sites, agricultural sites, and private land within Indiana has been less than 0.0005846% of the estimated natural mortality of these populations, and would be expected to be no more than 0.001% of total mortality in any one year under the current program. Regionally, WS's *confirmed kill*, which may be underestimated, averages less than a 131,068 blackbirds and starlings annually, which accounts for only 0.005% of the natural mortality. Even if WS's actual regional kill is much higher than the "confirmed" kill, it should continue to be well below normal mortality levels for these populations.

Dolbeer et al. (1995) showed that WS kills of 3.6% of the wintering population had no effect on breeding populations the following spring. Dolbeer et al. (1976) constructed a population model which indicated that a reduction of 14.8% of the wintering blackbird population would reduce the spring breeding population by 20% and that a 56.2% reduction in the wintering blackbird population would reduce spring breeding populations by only 33%. Given the density-dependent relationships in a blackbird population (i.e. decreased mortality and increased fecundity of surviving birds) a much higher number would likely have to be killed in order to impact the regional breeding population.

Cumulative impacts would be mortality caused by the IN WS program added to the other known human causes of mortality. Given that the maximum annual mortality caused by the IN WS program has not accounted for more than 0.0005846% of the regional blackbird population, and should not exceed 0.001% of the population in any future year. When added to the regional WS confirmed kill, the cumulative impacts of the proposed control projects implemented under this alternative is expected to have no significant impact on overall breeding populations.

Starlings, being non-indigenous and because of their negative impacts and competition with native birds, are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Any reduction in starling populations in North America, even to the extent of complete eradication, could be considered a beneficial impact to native bird species.

Feral Domestic Pigeon Population Impacts

The feral domestic pigeon, also known as the rock dove, is an introduced nonnative species in North America. Breeding Bird Survey trend data showed a slight annual decrease (-2.5%) and (-2.5%) from 1980-2000 for Indiana and the mid-west U.S., respectively (Sauer et al. 2001). Federal or state law does not protect the species. Any BDM involving lethal control actions by WS for this species would be restricted to isolated, individual sites, or communities. In those cases where feral domestic pigeons are causing damage or are a nuisance, complete removal of the local population could be achieved. This would be considered to be a beneficial impact on the human environment since the affected property owner or administrator would request it. Although regional population impacts would be minor, even if significant regional or nationwide reductions could be achieved, this would not be considered an adverse impact on the human environment because the species is not part of native ecosystems. However, some individuals who experience aesthetic enjoyment of pigeons may consider major population reduction in some localities a negative impact.

During FY 2001, IN WS lethally removed 33 pigeons, primarily to reduce hazards associated with dropping and damage in and around airport terminal buildings. This number of pigeons taken at multiple sites undoubtedly had little effect on overall pigeon populations in Indiana. Based upon an anticipated increase in future requests for WS assistance, WS predicts that no more than 250 pigeons would be lethally removed annually.

Canada Geese

Canada geese (*Branta canadensis*) are a large waterfowl that is found throughout North America. Breeding Bird Survey trend data indicates the species has been growing quickly within Indiana (13.4% annually) and the mid-west U.S. (13.4% annually) from 1980 to 2000 (Sauer et al. 2001). Canada geese are a widespread occupant of open areas, ponds and wetlands. Their primary diet is vegetative matter that includes items such as grass, corn, and soybeans. Canada geese are also very adaptive to urban settings and often thrive in areas such as public parks and retention ponds.

The state of Indiana monitors populations and sets harvest dates and limits governed by USFWS guidelines. The IDNR Mid-Winter 2000 Canada goose count of 17,858 which was lower than that in January 1999 (44,578). This was due primarily to the lack of cold weather and poor dry habitat conditions. Goose migration is largely dependent on weather conditions, especially in Michigan and Wisconsin (IDNR letter, Miller 2001). Habitat conditions in 2000 were also poor. Wetlands were dry in much of the state, and crops that year were average to below average. The 2001 season in Indiana allowed the following harvest: in the North Zone, the SJBP Zone, the South Zone, the Ohio River Zone**,** and Posey County Zone, bag limit is 2 Canada geese daily (6 in possession). In the Posey County Zone, the season ended on Jan. 31 or when a quota of 960 geese reached Hovey Lake FWA.

Canada geese are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on Canada goose populations would have no significant adverse impact on the quality of the human environment.

In FY 2001, WS did not lethally remove any birds, while harassing more than 500 birds from an airport. Statewide, the Canada goose harvest in 1999-2000 numbered 38,451. Based upon an anticipated increase in future requests for WS assistance at municipalities, industrial sites, agricultural sites, and private land within Indiana, WS predicts that no more than 100 geese would be lethally removed annually. Therefore, WS limited take should have minimal effects on Canada goose populations.

Raptors

Breeding Bird Survey data indicates that raptors have been stable to increasing throughout the Mid-west (Sauer et. al 2000). Raptors are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on raptor populations would have no significant adverse impact on the quality of the human environment.

In FY 2000, WS at Indiana airports has trapped and relocated a total of 11 birds (8 American kestrels and 3 red-tailed hawks), harassed more than 30 birds, and took no raptors via lethal control. Based upon an anticipated increase in future requests for WS assistance at municipalities, industrial sites, agricultural sites, and private land within Indiana, WS predicts that no more than 10 of each species of raptor would be lethally removed annually. Therefore, WS limited take should have minimal effects on raptor populations.

Killdeer

The killdeer is an upland shorebird with two black bands around its neck. It has a brown back and a white belly. The bird is technically classified as a shorebird, but is actually found in a variety of open areas, even concrete or asphalt parking lots at shopping malls, as well as fields and beaches, ponds, lakes, road-side ditches, mudflats, airports, pastures, and gravel roads and levees (Mumford 1984). The killdeer was formerly a common summer resident throughout the state and in some years remained in southern Indiana all winter. There has been a substantial increase in the numbers of killdeers in Indiana, for today they are abundant during migration and during the summer (Mumford 1984). The bird undoubtedly nests in every county in Indiana (Mumford 1984).

Killdeer are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on killdeer populations would have no significant adverse impact on the quality of the human environment.

Breeding Bird Survey trend data showed a slight annual increase (3.1%) and (2.7%) from 1980-2000 for Indiana and the mid-west U.S., respectively (Sauer et al. 2001).

In FY 2000, WS at Indiana airports took a maximum of 5 killdeer, while harassing more than 120. Based upon an anticipated increase in future requests for WS assistance at municipalities, industrial sites, agricultural sites, and private land within Indiana, WS predicts that no more than 50 killdeer would be lethally removed annually. Therefore, WS limited take should have minimal effects on killdeer populations.

Other Target Species

Target species, in addition to those analyzed above, have been killed in small numbers by WS during the past year and have included include no more than 20 individuals of a given species (Table 4-1). Other species that could be killed during BDM include any of the species listed in Section 1.2. Most of these birds are protected by the USFWS under the Migratory Bird Treaty Act and the take is limited by permit. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on these bird populations would have no significant adverse impact on the quality of the human environment.

Based upon an anticipated increase in future requests for WS assistance at municipalities, industrial sites, agricultural sites, and private land within Indiana, WS predicts that no more than 20 individuals of each of the above mentioned bird species would be lethally removed annually by WS. None of these species are expected to be taken by WS BDM at any level that would adversely affect overall bird populations.

4.1.1.2 Alternative 2 - Non-lethal BDM only, by WS

Under this alternative, WS would not lethally take any target bird species and only non-lethal BDM activities and technical assistance recommendations would be made or implemented. Although WS take of target bird species would not occur, it is likely that, without WS conducting some level of lethal BDM activities, property managers or outside contractors BDM efforts would increase, leading to similar or greater impacts on target species populations as those of the current program alternative. For the same reasons shown in the population impacts analysis in section 4.1.1.1, it is unlikely that target bird

populations would be adversely affected by implementation of this alternative.

4.1.1.3 Alternative 3 - Lethal BDM only, by WS

Under this alternative, WS would likely have a greater impact on the target bird species population at municipalities, industrial sites, agricultural sites, and private land within Indiana than Alternative 1. Only lethal BDM activities would be implemented to resolve bird damage in all situations. WS would not recommended or use any non-lethal BDM activities to reduce bird damage at such properties. It is likely that a greater number of birds would have to be removed lethally to attempt to achieve the same results as the proposed action. However based upon the information described in section 4.1.1.1, it is unlikely that target bird species populations would be adversely affected by implementation of this alternative.

4.1.1.4 Alternative 4 -No Federal WS BDM

Under this alternative, WS would have no impact on target bird species populations at municipalities, industrial sites, agricultural sites, and private land within Indiana. Increased property managers' efforts to reduce or prevent bird conflict could result in negative impacts on target species populations to an unknown degree. Impacts on target species under this alternative could be the same, less, or more than those of the proposed action, depending on the level of effort expended by property management. However, it is unlikely that target bird populations would be adversely affected by implementation of this alternative.

4.1.2 Effects on Non-target Species Populations, including Threatened and Endangered Species.

4.1.2.1 Alternative 1 – Implement a Federal Bird Damage Management/IBDM (Proposed Action/No Action)

Adverse Impacts on Non-target (non-T&E) Species. There has been no take of non-target species by WS during BDM activities at municipalities, industrial sites, agricultural sites, and private land within Indiana. While every precaution is taken to safeguard against taking non-target species, at times changes in local bird movement patterns and other unanticipated events could result in the incidental take of unintended species. These occurrences are rare and should not affect the overall populations of any species under the current program.

T&E Species Impacts. T&E species that are federally listed (or proposed for listing) for the State of Indiana are:

FEDERAL: LE=endangered, LT=threatened, LELT=different listings for specific ranges of species, PE=proposed endangered, PT=proposed threatened, E/SA=appearance similar to LE or LT species, **=not listed.

STATE: SX=extirpated, SE=endangered, ST=threatened, SR=rare, SSC=special concern, WL=watch list, SG=significant, SRE=state reintroduced.

Mammal

Species Name	Common Name	FED.	STATE

BOS BISON	AMERICAN BISON	**	SX
CANIS LUPUS	GRAY WOLF	LELT	SX
CANIS RUFUS	RED WOLF	LEXN	SX
CERVUS ELAPHUS	WAPITI OR ELK	**	SX
CONDYLURA CRISTATA	STAR-NOSED MOLE	**	SSC
CORYNORHINUS RAFINESQUII	RAFINESQUE'S BIG-EARED BAT	**	SSC
ERETHIZON DORSATUM	COMMON PORCUPINE	**	SX
FELIS CONCOLOR	COUGUAR/MOUNTAIN LION	LE	SX
FELIS LYNX	LYNX	**	SX
GEOMYS BURSARIUS	PLAINS POCKET GOPHER	**	SSC
GULO GULO	WOLVERINE	**	SX
LUTRA CANADENSIS	NORTHERN RIVER OTTER	**	SE
LYNX RUFUS	BOBCAT	**	SE
MARTES PENNANTI	FISHER	**	SX
MUSTELA NIVALIS	LEAST WEASEL	**	SSC
MYOTIS AUSTRORIPARIUS	SOUTHEASTERN MYOTIS	**	SE
MYOTIS GRISESCENS	GRAY MYOTIS	LE	SE
MYOTIS SODALIS	INDIANA OR SOCIAL MYOTIS	LE	SE
NEOTOMA MAGISTER	EASTERN WOODRAT	**	ST
NYCTICEIUS HUMERALIS	EVENING BAT	**	SE
RATTUS RATTUS	BLACK RAT	**	SX
REITHRODONTOMYS MEGALOTIS	WESTERN HARVEST MOUSE	**	SSC
SOREX FUMEUS	SMOKY SHREW	**	SSC
SOREX HOYI	PYGMY SHREW	**	SSC
SPERMOPHILUS FRANKLINII	FRANKLIN'S GROUND SQUIRREL	**	ST
SPILOGALE PUTORIUS	EASTERN SPOTTED SKUNK	**	SX
SYLVILAGUS AQUATICUS	SWAMP RABBIT	**	SE
TAXIDEA TAXUS	AMERICAN BADGER	**	ST
URSUS AMERICANUS	BLACK BEAR	T(S/A)	SX

Bird

ACCIPITER COOPERII	COOPER'S HAWK	**	WL
ACCIPITER STRIATUS	SHARP-SHINNED HAWK	**	SSC
AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW	**	SE
AMMODRAMUS HENSLOWII	HENSLOW'S SPARROW	**	ST
ARDEA ALBA	GREAT EGRET	**	SE
ARDEA HERODIAS	GREAT BLUE HERON	**	SSC
ASIO FLAMMEUS	SHORT-EARED OWL	**	SE
ASIO OTUS	LONG-EARED OWL	**	WL
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER	**	SE
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN	**	SE
BUTEO LINEATUS	RED-SHOULDERED HAWK	**	SSC
BUTEO PLATYPTERUS	BROAD-WINGED HAWK	**	SSC
CERTHIA AMERICANA	BROWN CREEPER	**	WL
CHARADRIUS MELODUS	PIPING PLOVER	LELT	SE
CHLIDONIAS NIGER	BLACK TERN	**	SE
CIRCUS CYANEUS	NORTHERN HARRIER	**	SE
CISTOTHORUS PALUSTRIS	MARSH WREN	**	SE
CISTOTHORUS PLATENSIS	SEDGE WREN	**	ST
CORAGYPS ATRATUS	BLACK VULTURE	**	WL

CORVUS CORAX	COMMON RAVEN	**	SX
CYGNUS BUCCINATOR	TRUMPETER SWAN	**	SE
DENDROICA CERULEA	CERULEAN WARBLER	**	SSC
DENDROICA KIRTLANDII	KIRTLAND'S WARBLER	LE	SE
EGRETTA CAERULEA	LITTLE BLUE HERON	**	WL
EMPIDONAX MINIMUS	LEAST FLYCATCHER	**	WL
EUPHAGUS CYANOCEPHALUS	BREWER'S BLACKBIRD	**	SX
FALCO PEREGRINUS	PEREGRINE FALCON	E(S/A)	SE
GAVIA IMMER	COMMON LOON	**	SX
GRUS CANADENSIS	SANDHILL CRANE	**	ST
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	LTNL	SE
HELMITHEROS VERMIVORUS	WORM-EATING WARBLER	**	SSC
ICTINIA MISSISSIPPIENSIS	MISSISSIPPI KITE	**	SSC
IXOBRYCHUS EXILIS	LEAST BITTERN	**	SE
LANIUS LUDOVICIANUS	LOGGERHEAD SHRIKE	**	SE
MNIOTILTA VARIA	BLACK-AND-WHITE WARBLER	**	SSC
NYCTANASSA VIOLACEA	YELLOW-CROWNED NIGHT-HERON	**	SE
NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON	**	SE
PANDION HALIAETUS	OSPREY	**	SE
PHALACROCORAX AURITUS	DOUBLE-CRESTED CORMORANT	**	SX
PHALAROPUS TRICOLOR	WILSON'S PHALAROPE	**	SX
RALLUS ELEGANS	KING RAIL	**	SE
RALLUS LIMICOLA	VIRGINIA RAIL	**	SSC
STERNA ANTILLARUM ATHALASSOS	INTERIOR LEAST TERN	LENL	SE
STERNA FORSTERI	FORSTER'S TERN	**	SX
STERNA HIRUNDO	COMMON TERN	**	SX
STURNELLA NEGLECTA	WESTERN MEADOWLARK	**	SSC
THRYOMANES BEWICKII	BEWICK'S WREN	**	SE
TYMPANUCHUS CUPIDO	GREATER PRAIRIE-CHICKEN	**	SX
TYTO ALBA	BARN OWL	**	SE
VERMIVORA CHRYSOPTERA	GOLDEN-WINGED WARBLER	**	SE
WILSONIA CANADENSIS	CANADA WARBLER	**	SSC
WILSONIA CITRINA	HOODED WARBLER	**	SSC
XANTHOCEPHALUS XANTHOCEPHALUS	YELLOW-HEADED BLACKBIRD	**	ST

Amphibian

ACRIS CREPITANS	NORTHERN CRICKET FROG	**		G5	S?
AMBYSTOMA BARBOURI	STREAMSIDE SALAMANDER	**	WL	G4	S3
AMBYSTOMA LATERALE	BLUE-SPOTTED SALAMANDER	**	SSC	G5	S2
ANEIDES AENEUS CRYPTOBRANCHUS	GREEN SALAMANDER	**	SE	G3G4	S?
ALLEGANIENSIS ALLEGANIENSIS	HELLBENDER	**	SE	G4T4	S1
HEMIDACTYLIUM SCUTATUM	FOUR-TOED SALAMANDER	**	ST	G5	S2
NECTURUS MACULOSUS	MUDPUPPY	**	SSC	G5	S2
PLETHODON RICHMONDI PSEUDOTRITON	RAVINE SALAMANDER	**	WL	G5	S2
RUBER RUBER	NORTHERN RED SALAMANDER	**	SE	G5T5	S1
RANA AREOLATA CIRCULOSA	NORTHERN CRAWFISH FROG	**	ST	G4T4	S2
RANA BLAIRI		**	SSC	G5	S2
RANA PIPIENS	PLAINS LEOPARD FROG	**	SSC	G5	S2
SCAPHIOPUS HOLBROOKII HOLBROOKII	NORTHERN LEOPARD FROG	**	SSC	G5T5	S2

Reptiles

	EASTERN SPADEFOOT	**	ST	G5T5	S1
AGKISTRODON PISCIVORUS LEUCOSTOMA	WESTERN COTTONMOUTH	**	ST	G5T5	S1
CEMOPHORA COCCINEA COPEI	NORTHERN SCARLET SNAKE	**	ST	G5	S2
CLEMMYS GUTTATA	SPOTTED TURTLE	**	ST	G2	S2
CLONOPHIS KIRTLANDII	KIRTLAND'S SNAKE	**	ST	G5	S2
CROTALUS HORRIDUS	TIMBER RATTLESNAKE	**	SE	G4	S2
EMYDOIDEA BLANDINGII	BLANDING'S TURTLE	**	SX	G5T5	SX
FARANCIA ABACURA REINWARDTII	WESTERN MUD SNAKE	**	ST	G5	S2
KINOSTERNON SUBRUBRUM	EASTERN MUD TURTLE	**	SE	G3G4	S1
MACROCLEMYS TEMMINCKII	ALLIGATOR SNAPPING TURTLE	PT	ST	G5T2	S2
NERODIA ERYTHROGASTER NEGLECTA	COPPERBELLY WATER SNAKE	**	SSC	G5	S3
OPHEODRYS AESTIVUS	ROUGH GREEN SNAKE	**	ST	G5	S2
OPHEODRYS VERNALIS	SMOOTH GREEN SNAKE	**		G5	S2
OPHISAURUS ATTENUATUS	SLENDER GLASS LIZARD	**	SE	G5T4	S1
PSEUDEMYS CONCINNA HIEROGLYPHICA	HIEROGLYPHIC RIVER COOTER	**	ST	G3G4T3	S2
SISTRURUS CATENATUS CATENATUS	EASTERN MASSASAUGA	**	ST	G5	S1
TANTILLA CORONATA	SOUTHEASTERN CROWNED SNAKE	**	SSC	G5	S2
TERRAPENE ORNATA	ORNATE BOX TURTLE	**	ST	G5	S1
THAMNOPHIS BUTLERI	BUTLER'S GARTER SNAKE	**	SSC	G5	S3
THAMNOPHIS PROXIMUS	WESTERN RIBBON SNAKE				

Beetles

BATRISODES KREKELERI	CAVE BEETLE	**	SE	G1	S1
CICINDELA MARGINIPENNIS	COBBLESTONE TIGER BEETLE	**	SE	G2G3	S1
CICINDELA PATRUELA	A TIGER BEETLE	**		G3	S3
DRYOBIUS SEXNOTATUS	SIX-BANDED LONGHORN BEETLE	**	ST	G?	S?
DYNASTES TITYUS	UNICORN BEETLE	**	SR	G?	S2
LISSOBIOPS SERPENTINUS	A ROVE BEETLE	**	SE	G?	S1
NICROPHORUS AMERICANUS	AMERICAN BURYING BEETLE	LE	SX	G1	SH
OCHTHEBIUS PUTNAMENSIS	INDIANA OCHTHEBIUS	**	SR	GH	S2
	MINUTE MOSS BEETLE				
PSEUDANOPHTHALMUS BARRI	CAVE BEETLE	**	SE	G1	S1
PSEUDANOPHTHALMUS CHTHONIUS	CAVE BEETLE	**	SE	G1	S1
PSEUDANOPHTHALMUS EMERSONI	CAVE BEETLE	**	SE	G1	S1
PSEUDANOPHTHALMUS EREMITA	CAVE BEETLE	**	SE	G1	S1
PSEUDANOPHTHALMUS JEANNELI	CAVE BEETLE	**	SE	G?	S1
PSEUDANOPHTHALMUS LEONAE	CAVE BEETLE	**	SE	G1	S1
PSEUDANOPHTHALMUS SHILOHENSIS	CAVE BEETLE	**	SE	G1	S1
PSEUDANOPHTHALMUS SHILOHENSIS BOONENSIS	CAVE BEETLE	**	SE	G?	S1
PSEUDANOPHTHALMUS SHILOHENSIS MAYFIELDENSIS	CAVE BEETLE	**	SE	G?	S1
PSEUDANOPHTHALMUS TENUIS	CAVE BEETLE	**	ST	G2	S2
PSEUDANOPHTHALMUS TENUIS BLATCHLEYI	CAVE BEETLE	**	SE	G?	S1
PSEUDANOPHTHALMUS TENUIS MORRISONI	CAVE BEETLE	**	SE	G?	S1
PSEUDANOPHTHALMUS YOUNGI	CAVE BEETLE	**	SE	G1	S1
PSEUDANOPHTHALMUS YOUNGI DONALDSONI	CAVE BEETLE	**	SE	G?	S1

Dragonflies, Damselflies

AESHNA CANADENSIS	CANADA DARNER	**		G5	S1
AESHNA CLEPSYDRA	MOTTLED DARNER	**		G4	S1S2
AESHNA MUTATA	SPATTERDOCK DARNER	**		G3G4	S2S3
AESHNA TUBERCULIFERA	BLACK-TIPPED DARNER	**		G4	S2
ANAX LONGIPES ARCHILESTES GRANDIS	GREAT SPREADWING	**		G5	S4
ARIGOMPHUS CORNUTUS	HORNED CLUBTAIL	**		G4	S1
ARIGOMPHUS FURCIFER	LILYPAD CLUBTAIL	**		G5	S1
ARIGOMPHUS LENTULUS	STILLWATER CLUBTAIL	**		G5	S1
ARIGOMPHUS VILLOSIPES	UNICORN CLUBTAIL	**		G5	S2
CALOPTERYX AEQUABILIS	RIVER JEWELWING	**		G5	S1
CALOPTERYX ANGUSTIPENNIS	APPALACHIAN JEWELWING	**		G4	S1?
CELITHEMIS MONOMELAENA	BLACK SPOTTED SKIMMER	**		G5Q	S1
CELITHEMIS VERNA	DOUBLE-RINGED PENNANT	**		G5	S1
CHROMAGRION CONDITUM	AURORA DAMSEL	**		G5	S2S3
CORDULEGASTER BILINEATA	BROWN SPIKETAIL	**		G5	S1
CORDULEGASTER DIASTATOPS	DELTA-SPOTTED SPIKETAIL	**		G5	S1
CORDULEGASTER ERRONEA	TIGER SPIKETAIL	**		G4	S1
CORDULEGASTER MACULATA	TWIN-SPOTTED SPIKETAIL	**		G5	S2S3
CORDULEGASTER OBLIQUA	ARROWHEAD SPIKETAIL	**		G4	S2S3
DOROCORDULIA LIBERA	RACKET-TAILED EMERALD	**		G5	SH

ENALLAGMA BOREALE	BOREAL BLUET	**		G5	S1S2
ENALLAGMA CYATHIGERUM	NORTHERN BLUET	**		G5	S1S2
ENALLAGMA DIVAGANS	TURQUOISE BLUET	**		G5	S2?
ERPETOGOMPHUS DESIGNATUS	EASTERN RINGTAIL	**		G5	S2
GOMPHUS CRASSUS	HANDSOME CLUBTAIL	**		G3G4	S2
GOMPHUS LINEATIFRONS	SPLENDID CLUBTAIL	**		G4	S2S3
GOMPHUS QUADRICOLOR	RAPIDS CLUBTAIL	**		G3G4	S2
GOMPHUS SPICATUS	DUSKY CLUBTAIL	**		G5	S2
GOMPHUS VENTRICOSUS	SKILLET CLUBTAIL	**		G3	S1S2
GOMPHUS VIRIDIFRONS	GREEN-FACED CLUBTAIL	**		G3	S1
HAGENIUS BREVISTYLUS	DRAGONHUNTER	**		G5	S2S3
HETAERINA TITIA	SMOKY RUBYSPOT	**		G5	S2S3
ISCHNURA KELLICOTTI	LILYPAD FORKTAIL	**		G5	S2?
ISCHNURA PROGNATA	FURTIVE FORKTAIL	**		G4	S1?
LEUCORRHINIA FRIGIDA	FROSTED WHITEFACE	**		G5	S2S3
MACROMIA GEORGINA	GEORGIA RIVER CRUISER	**		G5	S2S3
MACROMIA PACIFICA	GILDED RIVER CRUISER	**		G4	S1
MACROMIA WABASHENSIS	WABASH BELTED SKIMMER DRAGONFLY	**		G1G3Q	S1
NANNOTHEMIS BELLA	DWARF SKIMMER	**		G4	S1S2
NEHALENNIA GRACILIS	SPHAGNUM SPRITE	**		G5	S1
NEUROCORDULIA OBSOLETA	UMBER SHADOWFLY	**		G4	S1
NEUROCORDULIA YAMASKANENSIS	STYGIAN SHADOWFLY	**		G5	S1
OPHIOGOMPHUS RUPINSULENSIS	RUSTY SNAKETAIL	**		G5	S2S3
SOMATOCHLORA ENSIGERA	LEMON-FACED EMERALD	**		G4	S1
SOMATOCHLORA HINEANA	OHIO EMERALD DRAGONFLY	LE	SX	G2	SX
SOMATOCHLORA LINEARIS	MOCHA EMERALD	**		G5	S2S3
SOMATOCHLORA TENEBROSA	CLAMP-TIPPED EMERALD	**		G5	S2S3
STYLURUS AMNICOLA	RIVERINE CLUBTAIL	**		G3G4	S1S2
STYLURUS LAURAE	LAURA'S CLUBTAIL	**		G3G4	S1S2
STYLURUS NOTATUS	ELUSIVE CLUBTAIL DRAGONFLY	**		G3G4	S1
SYMPETRUM DANAE	BLACK MEADOWFLY	**		G5	S2
SYMPETRUM SEMICINCTUM	BAND-WINGED MEADOWFLY	**		G5	S2S3
TACHOPTERYX THOREYI	GRAY PETALTAIL	**		G4	S2S3
TETRAGONEURIA SPINIGERA	SPINY BASKETTAIL	**		G5	S1

Butterflies, Skippers, Moths

AMBLYSCIRTES AESCULAPIUS	BELL'S ROADSIDE SKIPPER	**		G4	S1
AMBLYSCIRTES BELLI	SALT-AND-PEPPER SKIPPER	**		G4	S1S2
AMBLYSCIRTES HEGON	VEINED WHITE	**	WL	G5	S1S3
ARTOGEIA NAPI OLERACEA	WEST VIRGINIA WHITE	**	SE	G5T4	S1
ARTOGEIA VIRGINIENSIS	DUSTED SKIPPER	**	SR	G4	S3
ATRYTONOPSIS HIANNA	GOLDEN-BANDED SKIPPER	**	ST	G4G5	S2S3
AUTOCHTON CELLUS	NOCTUID MOTH	**	WL	G4	S1S2
BELLURA DENSA	MYRINA SILVER-BORDERED	**		G5	S?
BOLORIA SELENE	FRITILLARY				
	NORTHERN METALMARK	**		G5T5	S2S3
CALEPHELIS BOREALIS	SWAMP METALMARK	**	SR	G3G4	S3
CALEPHELIS MUTICA	RED-BANDED HAIRSTREAK	**		G4	S2S3
CALYCOPIS CECROPS	MARBLED UNDERWING	**		G5	S2S3
	MOTH				
CATOCALA DULCIOLA	SOOTY AZURE	**		G3	S?
CATOCALA MARMORATA	APPALACHIAN BLUE	**	WL	G4	S1
CELASTRINA EBENINA	HARRIS' CHECKERSPOT	**	SR	G4	S2
CELASTRINA NEGLECTA MAJOR	GEMMED SATYR	**	SR	G4	S1S2
CHLOSYNE HARRISII	CREOLE PEARLY EYE	**	SX	G4	S2
CYLLOPSIS GEMMA	PINKPATCHED LOOPER	**	ST	G5	S2
	MOTH				
ENODIA CREOLA	COLUMBINE DUSKYWING	**		G4?	SU
EOSPHOROPTERYX THYATYROIDES	MOTTLED DUSKYWING	**		G4G5	S2
ERYNNIS LUCILIUS	PERSIUS DUSKYWING	**	ST	G4	S1?
ERYNNIS MARTIALIS	OLYMPIA MARBLEWING	**	SE	G4	S3
ERYNNIS PERSIUS PERSIUS	BALTIMORE	**	ST	G4T2T3	S1S2
EUCHLOE OLYMPIA	TWO-SPOTTED SKIPPER	**		G4	S2
EUPHYDRYAS PHAETON	SCARCE SWAMP SKIPPER	**	SR	G4	S2S4
EUPHYES BIMACULA	NORTHERN HAIRSTREAK	**	SR	G4	S2
EUPHYES DUKESI	SILVERY BLUE	**	WL	G3	S2
EURISTRYMON ONTARIO	MIDWESTERN FEN	**	SE	G4	S2S4
GLAUCOPSYCHE LYGDAMUS COUPERI	BUCKMOTH	**		G5T4	S1
HEMILEUCA SP 3	CAROLINA SATYR	**		G3G4	S1?
	SKIPPER				
HERMEUPTYCHIA SOSYBIUS HESPERIA	COBWEB SKIPPER	**	SR	G5Q	S1S2
LEONARDUS LEONARDUS	OTTOE SKIPPER	**	ST	G4	S2
HESPERIA METEA	INDIAN SKIPPER	**	SE	G4G5	S2S3
HESPERIA OTTOE	A PROMINENT MOTH	**	SR	G3?	S1
HESPERIA SASSACUS	HENRY'S ELFIN	**	ST	G5	S3
HYPERAESCHRA TORTUOSA	FROSTED ELFIN	**		G?	S2
INCISALIA HENRICI TURNERI	HOARY ELFIN	**	SR	G5T4T5	S2S4
INCISALIA IRUS	KARNER BLUE BUTTERFLY	**	SR	G4	S2
INCISALIA POLIA	DORCAS COPPER	**	SE	G5	S1?
LYCAEIDES MELISSA SAMUELIS	BOG COPPER	LE		G5T2	S1
LYCAENA DORCAS DORCAS	PURPLISH COPPER	**	SX	G4TU	S2
LYCAENA EPIXANTHE	GREAT COPPER	**		G4G5	SX
LYCAENA HELLOIDES	A LYTROSIS MOTH	**	WL	G5	S2S4
LYCAENA XANTHOIDES	BARRENS METARRANTHIS	**	ST	G5	S?
		**			

LYTROSIS PERMAGNARIA	OLIVE HAIRSTREAK	**	WL		
METARRANTHIS APICIARIA	MITCHELL'S SATYR	**		GU	SH
	POWESHIEK SKIPPER	LE			
MITOURA GRYNEA GRYNEA	RATTLESNAKE-MASTER	**	SE	G5T5	S2S4
NEONYMPHA MITCHELLII MITCHELLII	BORER MOTH	**	SX	G2T2	S1
OARISMA POWESHEIK	COLUMBINE BORER	**		G2G3	SH
PAPAIPEMA ERYNGII	WHITE M HAIRSTREAK	**	SX	G1	SX
	VIATOR BROAD-WINGED	**	WL	G4	S?
PAPAIPEMA LEUCOSTIGMA	SKIPPER	**		G5	S1S3
PARRHASIUS M-ALBUM	GRAY COMMA	**	SR	G5T4	S2
POANES VIATOR	BUNCHGRASS SKIPPER	**	SR	G5	S2S4
	ANNOINTED SALLOW MOTH	**	SR	G3G4	S2
POLYGONIA PROGNE	APPALACHIAN EYED		SE	GU	S2
PROBLEMA BYSSUS	BROWN	**		G5T5	S1
PYREFERRA CEROMATICA SATYRODES	SMOKEY-EYED BROWN	**		G5T3T4	S1S2
APPALACHIA APPALACHIA	GLORIUS FLOWER MOTH	**	WL	G4	SU
SATYRODES EURYDICE FUMOSA	INDIANA PHLOX MOTH	**	SE	GU	S1
SCHINIA GLORIOSA SCHINIA	ATLANTIS FRITILLARY	**		G5	S1?
SPEYERIA ATLANTIS SPEYERIA	REGAL FRITILLARY	**		G3	SX
DIANA DIANA	CONFUSIS EASTERN	**	SE	G3	S1
SPEYERIA IDALIA THORYBES	CLOUDYWING			G4	S1?

Mayflies

ANEPEORUS SIMPLEX	FLAT-HEADED MAYFLY	**	SE	G3G5	S1
EPEORUS NAMATUS	A MAYFLY	**	SE	G?	S1
EPHEMERELLA ARGO ARGO	EPHEMERELLAN MAYFLY	**	SE	G1G3	S?
HOMOEONEURIA AMMOPHILA	A SAND-FILTERING MAYFLY	**	SE	G4G5	S1
PARACLOEODES MINUTUS	A SMALL MINNOR MAYFLY	**	SR	G?	S2
PENTAGENIA ROBUSTA	ROBUST PENTAGENIA BURROWING MAYFLY	**	SX	GH	SX
PENTAGENIA VITTIGERA	PENTAGENIAN BURROWING MAYFLY	**	ST	G4G5	S2
PSEUDIRON CENTRALIS	A MAYFLY	**	SE	G?	S1
RAPTOHEPTAGENIA CRUENTATA	FLATHEADED MAYFLY	**	SE	G?	S1
SIPHLOPLECTON BASALE	SAND MINNOW MAYFLY	**	SE	G?	S2
SIPHLOPLECTON INTERLINEATUM	SAND MINNOW MAYFLY	**		G?	S1
SPINADIS WALLACEI	WALLACE'S DEEPWATER MAYFLY	**	SE	G?	S?
TORTOPUS PRIMUS	A MAYFLY	**	ST	G?	S2

WS BDM activities at municipalities, industrial sites, agricultural sites, and private land within Indiana would not adversely affect any Federal or State listed T&E species, including those listed above. This determination is based on the conclusions made by the FWS during their 1992 programmatic consultation of WS activities and subsequent Biological Opinion. The FWS determined that the management activities being utilized for WS BDM at municipalities, industrial sites, agricultural sites, and private land within Indiana are not likely to adversely affect those species listed in the 1992 Biological Opinion (USDA 1997). Furthermore, WS has conducted an

informal section 7 with the USFWS and IDNR, who both concur with WS findings (USFWS letter, Hudak 1996).

The 1992 Biological Opinion (B.O.) from the USFWS concluded that the interior least tern, and piping plover would not be adversely affected by any aspect of the WS program which included all methods of BDM described herein (USDA 1997, Appendix F).

DRC-1339 poses no primary hazard to eagles because eagles do not eat grain or other bait materials on which this chemical might be applied during BDM, and, further, because eagles are highly resistant to DRC-1339. Up to 100 mg doses were force fed to captive golden eagles with no mortality or adverse effects noted other than regurgitation and head-shaking (Larsen and Dietrich 1970). Secondary hazards to raptors from DRC-1339 and Avitrol are low to nonexistent (see Appendix B). Therefore, WS BDM at municipalities, industrial sites, agricultural sites, and private land within Indiana will have no adverse effects on bald eagles.

Mitigation measures to avoid non-target and T&E species impacts are described in Chapter 3 (section 3.4.2.2). The inherent safety features of DRC-1339 use that precludes or minimize hazards to mammals and plants are described in Appendix B and in a formal risk assessment in the ADC FEIS (USDA 1997, Appendix P). Those measures and characteristics should assure there would be no jeopardy to T&E species or adverse impacts on mammalian or non-T&E bird scavengers from the proposed action.

4.1.2.2 Alternative 2 – Non-lethal BDM only, by WS

Under this alternative, WS take of non-target species would probably be less than that of the proposed action because WS would take no lethal control actions. However, non-target take would not differ substantially from the current program because the current program has taken no non-target species. On the other hand, properties whose bird damage problems were not effectively resolved by non-lethal control methods and recommendations would likely resort to other means of lethal control such as use of shooting by property managers/owners. This could result in less experienced persons implementing control methods and could lead to greater take of non-target species than the proposed action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds.

4.1.2.3 Alternative 3 - Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be recommended and implemented to resolve bird conflicts in all situations. WS would not recommended or use any non-lethal BDM activities to reduce bird damage at municipalities, industrial sites, agricultural sites, and private land within Indiana. WS take of non-target species would not differ substantially from the current program described in section 4.1.2.1. Because fewer BDM control methods would be available for use by WS, it would be more difficult to reduce bird conflicts to an acceptable level. This could lead to non-WS personnel to implement their own less selective BDM activities. Technical support would lead to more appropriate use of lethal control methods by non-WS personnel. Property manager/owner efforts to reduce or prevent damage could still result in less experienced persons implementing control methods that could lead to greater take of non-target birds than under the proposed action.

4.1.2.4 Alternative 4 - No Federal WS BDM

Alternative 4 would not allow any WS BDM at municipalities, industrial sites, agricultural sites,

and private land within Indiana. There would be no impact on non-target or T&E species by WS BDM activities from this alternative. However, property manager/owner efforts to reduce or prevent conflicts could increase, which could result in less experienced persons implementing control methods that could lead to greater take of non-target species than under the proposed action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds.

4.1.3 Economic Losses to Property as a Result of Bird Damage

4.1.3.1 Alternative 1- Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)

Many property owners and managers are concerned with the economic cost associated with damage caused by birds to property. Birds can cause severe damage or total loss to property, structural damage to buildings, damage to equipment, manufactured products and food, and obstruction or damage to water control structures. Integrated BDM, a combination of lethal and non-lethal means, has the greatest potential of successfully reducing the risk of bird damage. All BDM methods could possibly be implemented and recommended by WS.

4.1.3.2 Alternative 2 – Non-lethal BDM only, by WS

Under this alternative, WS would be restricted to implement and recommend only non-lethal methods to provide assistance for bird damage. Bird damage could increase under this alternative if non-lethal techniques were ineffective. Property managers requesting BDM assistance to reduce bird damage would not be provided information or services in lethal control. If non-lethal methods did not reduce or eliminate the bird damage, no WS options would be available. Property managers/owners would then be required to develop and implement their own lethal program. These programs would have a potential for limited success, depending upon the expertise of the personnel involved. Therefore, bird damage to property could remain the same or greater than the proposed action.

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4.1.3.3 Alternative 3 - Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be implemented or recommended to resolve bird damage to property in all situations. Toxicants, drugs, lethal trapping, and shooting would be available for use, however, due to safety considerations and Federal and State regulations all lethal BDM methods may not be available for use in all situations. In areas where lethal BDM could not be conducted, such as areas on a property where discharge of firearms is not safe or allowed, bird damage would not be reduced. In these situations, WS would not be able to recommend or use non-lethal methods that would otherwise be available under the proposed action. If property manager/owner did not implement his/her own non-lethal program in this particular situation, the likely result would be persistent or increased bird damage to property. Therefore, bird damage to property could remain the same or greater than the proposed action.

4.1.3.4 Alternative 4 - No Federal WS BDM

With no WS assistance, property manager/owner would be responsible for developing and implementing his/her own BDM program. Negative impacts on bird damage to property could be greater under this alternative than the proposed action. . Efforts to reduce or prevent conflicts could result in less experienced persons implementing control methods, therefore leading to a greater potential for bird property damage to continue, than under the proposed action.

4.1.4 Effects on Human Health and Safety

4.1.4.1 Safety and efficacy of chemical control methods

Alternative 1 – Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)

DRC-1339 (3-chloro-p-toluidine hydrochloride). DRC-1339 is the primary lethal chemical method that would be used for lethal bird control. There has been some concern expressed by a few members of the public that unknown but significant risks to human health may exist from DRC-1339 used for BDM.

This chemical is one of the most extensively researched and evaluated pesticides ever developed. Over 30 years of studies have demonstrated the safety and efficacy of this compound. Appendix B provides more detailed information on this chemical and its use in BDM. Factors that virtually eliminate any risk of public health problems from use of this chemical are:

X Its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops (contrary to some misconceptions expressed by a few members of the public, DRC-1339 is not applied to feed materials that livestock can feed upon).

X DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours, which means that treated bait material generally is nearly 100% broken down within a week.

X It is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people.

X Application rates are extremely low (less than 0.1 lb. of active ingredient per acre) (EPA 1995).

X A human would need to ingest the internal organs of birds found dead from DRC-1339 to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur.

X The EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (i.e., cancer-causing agent) (EPA 1995). Regardless, however, the extremely controlled and limited circumstances in which DRC-1339 is used would prevent any exposure of the public to this chemical.

The above analysis indicates that human health risks from DRC-1339 use would be virtually nonexistent under any alternative.

Avitrol (4-Aminopyridine). Avitrol is another chemical method that might be used by WS for bird control. Although this chemical was not identified as being one of concern for human health effects, analysis of the potential for adverse effects is presented here. Appendix B provides more detailed information on this chemical.

Avitrol is available as a prepared grain bait mixture that is mixed in with clean bait at no greater

than a 1:9 treated to untreated mixture. In addition to this factor, other factors that virtually eliminate health risks to members of the public from use of this product as an avicide are:

X It is readily broken down or metabolized into removable compounds that are excreted in urine in the target species (ETOXNET 1996). Therefore, little of the chemical remains in killed birds to present a hazard to humans.

X A human would need to ingest the internal organs of birds found dead from Avitrol ingestion to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur. Furthermore, secondary hazard studies with mammals and birds have shown that there is virtually no hazard of secondary poisoning.

X Although Avitrol has not been specifically tested as a cancer-causing agent, the chemical was found not to be mutagenic in bacterial organisms (EPA 1997). Therefore, the best scientific information available indicates it is not a carcinogen. Regardless, however, the extremely controlled and limited circumstances in which Avitrol is used would prevent exposure of members of the public to this chemical.

The above analysis indicates that human health risks from Avitrol use would be virtually nonexistent under any alternative.

Other BDM Chemicals. Other non-lethal BDM chemicals that might be used or recommended by WS include repellents such as methyl anthranilate (artificial grape flavoring used in foods and soft drinks sold for human consumption), Flight Control®, which is used as an area repellent, and the tranquilizer drug Alpha-chloralose. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before EPA or FDA would register them. Any operational uses of chemical repellents would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations that are established to avoid unreasonable adverse effects on the environment.

Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid adverse effects on human health. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997).

4.1.4.1.2 Alternative 2 – Non-lethal BDM only, by WS

Alternative 2 would not allow for any lethal methods use by WS at municipalities, industrial sites, agricultural sites, and private land within Indiana. WS could only implement non-lethal methods such as harassment and exclusion devices and materials. Non-lethal methods could, however, include the tranquilizer drug Alpha-chloralose and chemical repellents such as methyl anthranilate and Flight Control®. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before EPA or FDA registers them. Any operational use of chemical repellents would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations and FDA rules, which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid adverse effects on human health.

4.1.4.1.3 Alternative 3 - Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be implemented to resolve bird damage in all situations. WS would not recommended or use any non-lethal BDM activities to reduce bird damage at municipalities, industrial sites, agricultural sites, and private land within Indiana. WS's use of chemical BDM methods would not differ substantially from the proposed action.

4.1.4.1.4 Alternative 4 - No Federal WS Bird Damage Management

Alternative 4 would not allow any WS BDM at municipalities, industrial sites, agricultural sites, and private land within Indiana. Concerns about human health risks from WS's use of chemical BDM methods would be alleviated because no such use would occur. DRC-1339 and Alpha-Chloralose are only registered for use by WS personnel, and would not be available for use by property managers or government contractors. The immobilizing and euthanizing chemicals are only available for use by certified WS personnel or a licensed veterenarian. Commercial pest control services would be able to use Avitrol and such use would likely occur to a greater extent in the absence of WS's assistance. However, use of Avitrol in accordance with label requirements should avoid any hazard to members of the public.

4.1.4.2 Impacts on human safety of non-chemical BDM methods

4.1.4.2.1 Alternative 1 – Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)

Non-chemical BDM methods that might raise safety concerns include shooting with firearms, use of traps, and harassment with pyrotechnics. Firearms are only used by WS personnel who are experienced in handling and using them. WS traps are strategically placed to minimize exposure to humans and pets. WS personnel receive safety training on a periodic basis to keep them aware of safety concerns. The IN WS program has had no accidents involving the use of firearms, traps, or pyrotechnics in which a member of the armed forces or the public were harmed. A formal risk assessment of WS's operational management methods found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no adverse impacts on human safety from WS's use of these methods are expected.

4.1.4.2.2 Alternative 2- Non-lethal by BDM only, by WS

Under this alternative, WS would not use firearms for lethal control during BDM but would still be able to use them as a harassment method. WS would also use pyrotechnics. Risks to human safety from WS's use of firearms, lethal control and pyrotechnics hypothetically would be similar to the current program alternative. IN WS's current BDM program has an excellent safety record of no accidents involving these devices have occurred resulting in a member of the armed forces or public being harmed. Increased use of these devices by less experienced and trained individuals would probably occur under this alternative. Impacts from this alternative could be greater or about the same as the proposed action.

4.1.4.2.3 Alternative 3 – Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be implemented to resolve bird damage in all situations. WS would not recommended or use any non-lethal BDM activities to reduce bird damage at municipalities, industrial sites, agricultural sites, and private land within Indiana. WS's use of non-chemical lethal BDM methods, the use of firearms, and traps, would not differ

substantially from the program described in Alternative 1. Although technical support, might lead to more selective use of lethal control methods by property managers than that which might occur under Alternative 2, efforts to reduce or prevent conflicts could still result in less experienced persons implementing control methods.

4.1.4.2.4 Alternative 4 - No Federal WS Bird Damage Management

Under this alternative, WS would not engage in or recommend use of any non-chemical BDM methods. Risks to human safety from WS's use of firearms, traps, and pyrotechnics would hypothetically be lower than the current program alternative. However, increased use of firearms, traps, and pyrotechnics by less experienced and trained private individuals would probably occur without WS assistance. Risks to human safety under this alternative could increase or remain about the same as the proposed action.

4.1.4.3 Impacts on Human Safety from Birds

4.1.4.3.1 Alternative 1 -- Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)

Indiana residents are concerned with potential injury, illness, and loss of human life as a result of the potential impacts of injurious bird species. An Integrated BDM strategy, a combination of lethal and non-lethal means, has the greatest potential of successfully reducing the risk of negative impacts from bird species. All BDM methods could possibly be implemented and recommended by WS.

4.1.4.3.2 Alternative 2 – Non-lethal BDM only, by WS

Under this alternative, WS would be restricted to implement and recommend only non-lethal methods to provide assistance for bird damage. Negative impacts such as: contamination of food and other consumable products, zoonotic disease transmission, property damage, and unsanitary conditions could increase under this alternative if non-lethal techniques were ineffective. Cooperators requesting BDM assistance to reduce bird damage would not be provided information or services in lethal control. If non-lethal methods did not reduce or eliminate the bird hazard, no WS options would be available. Cooperators would then be required to implement their own lethal program with success, dependent upon the expertise of the personnel involved. Therefore bird damage could be greater or remain the same as the proposed action.

4.1.4.3.3 Alternative 3 - Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be implemented or recommended to resolve bird-related hazards in all situations. However, due to safety considerations and city ordinances all lethal BDM methods would not be available for use in all situations. In areas where lethal BDM could not be conducted, such as areas on any property where discharge of firearms is not safe or allowed, bird hazards would not be reduced. In these situations WS would not be able to recommend or use non-lethal methods that otherwise would be available under the proposed action. If cooperators did not implement their own non-lethal program in this particular situation, the likely results would be that bird damage would remain the same or increase. Therefore, impacts on human health and safety could be greater under this alternative than the proposed action.

4.1.4.3.4 Alternative 4 - No Federal WS BDM

With no WS assistance, cooperators would be responsible for developing and implementing their own BDM program. Cooperator efforts to reduce or prevent conflicts could result in less experienced persons implementing control methods, therefore leading to a greater potential of not reducing bird hazards, than under the proposed action.

4.1.5 Effects on Aesthetics

4.1.5.1 Effects on Human Affectionate-Bonds with Individual Birds and on Aesthetic Values of Bird Species

4.1.5.1.1 Alternative 1 - - Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)

Some people who routinely view or feed individual birds such as geese and feral pigeons would likely be disturbed by removal of such animals under the current program. Some people have expressed opposition to the killing of any animal during BDM activities. Under the current program, some lethal control of birds would continue and these persons would continue to be opposed. However, many persons who voice opposition has no direct connection or opportunity to view or enjoy the particular birds that would be killed by WS's lethal control activities. Lethal control actions would generally be restricted to local sites and to small, insubstantial percentages of overall populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant and would therefore continue to remain available for viewing by persons with that interest.

Some people do not believe that birds or bird roosts should even be harassed to stop or reduce damage problems. Some people who enjoy viewing birds would feel their interests are harmed by WS's non-lethal harassment program. Mitigating that impact, however, is the fact that a harassment program does not diminish overall numbers of birds in the area. People who like to view these species can still do so on State wildlife management areas, as well as numerous private property sites where the owners are not experiencing damage from wild birds and are tolerant of their presence.

4.1.5.1.2 Alternative 2 – Non-lethal BDM only, by WS

Under this alternative, WS would not conduct any lethal BDM but would still conduct harassment of birds that was causing damage. Some people who oppose lethal control of birds by government but are tolerant of government involvement in non-lethal bird damage management would favor this alternative.

Some people do not believe that birds or bird roosts should even be harassed to stop or reduce damage problems. Some people who enjoy viewing birds would feel their interests are harmed by WS's non-lethal harassment program. Mitigating that impact, however, is the fact that a harassment program does not diminish overall numbers of birds in the area. People who like to view these species can still do so on State wildlife management areas, as well as numerous private property sites where the owners are not experiencing damage from wild birds and are tolerant of their presence.

Persons who have developed affectionate bonds with individual wild birds would not be affected by WS's lethal BDM activities under this alternative because WS would not kill the individual animal(s). However, property managers would likely conduct lethal BDM activities that would no longer be conducted by WS. Therefore the impacts of this alternative would be similar to the proposed action.

4.1.5.1.3 Alternative 3 - Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be implemented or recommended. People that have expressed opposition to the killing of any bird during BDM activities would likely be opposed to this alternative. Non-lethal methods would not be used or recommended by WS, therefore impacts of this alternative would be greater than the propose action.

4.1.5.1.4 Alternative 4 - No Federal WS BDM

Under this alternative, WS would not conduct any lethal or non-lethal BDM activities. Some people who oppose any government involvement in bird damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by WS's activities under this alternative. However, property managers/personnel would likely conduct similar BDM activities as those that would no longer be conducted by WS, resulting in impacts similar to the current program alternative.

4.1.5.2 Effects on Aesthetic Values of Property Damaged by Birds

4.1.5.2.1 Alternative 1 - - Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)

Under this alternative, WS would provide operational and technical assistance in reducing bird problems in which droppings are causing an unsightly mess and would, if successful, improve aesthetic values of affected properties. All BDM methods would be available for use, including the use of DRC-1339 and Alpha-chloralose. Relocation of nuisance roosting birds by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities to monitor the birds' movements is generally conducted to assure they do not reestablish in other undesirable locations.

4.1.5.2.2 Alternative 2 – Non-lethal BDM only, by WS

Under this alternative, WS would only provide non-lethal operational and technical assistance to reduce problems in which droppings from birds have caused an unsightly mess and would, if successful, improve aesthetic values of affected properties. Relocation of nuisance roosting birds by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities to monitor the birds' movements are generally conducted to assure they do not reestablish in other undesirable locations.

If non-lethal BDM methods were not effective in reducing bird problems, WS would not be able to recommend or implement any potential successful lethal BDM method. Property managers would then have the option of doing nothing, which would not reduce the problem, or implement their own control methods, which can have varying success. Overall, impacts of improving aesthetics would be slightly less than the proposed action.

4.1.5.2.3 Alternative 3 -. Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be implemented or recommended. This alternative would result in nuisance birds being removed by lethal means only. Where lethal BDM could be conducted, bird damage would likely be reduced to acceptable levels. In areas where lethal BDM could not be conducted, such as areas within municipalities where discharge of firearms is not safe or allowed, bird damage would not be reduced. Each site would be required to develop and implement their own non-lethal BDM programs. Relocation of nuisance birds or bird roosts through harassment, barriers, or habitat alteration can sometimes result in causing the same problems at the new location. If WS does not provided

non-lethal assistance to various personnel at municipalities, industrial sites, agricultural sites, and private land, coordination with local authorities to monitor bird movements to assure they do not reestablish in other undesirable locations might not be conducted. Thus, this alternative could likely result in more property owners experiencing adverse effects on the aesthetic values of their properties than the current program alternative.

4.1.5.2.4 Alternative 4 - No Federal WS BDM

Under this alternative, WS would not provide any operational or technical assistance in reducing bird problems. Aesthetic values of the aforementioned sites in Indiana would continue to be adversely affected, if such personnel were not able to implement there own BDM, or reduce damage in some other way. In many cases, this type of aesthetic "damage" would increase as a resulting of such personnel not being able to resolve their problems. Bird numbers would continue to increase, resulting in a greater chance of adverse impacts than with the proposed action.

4.1.6 Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS

4.1.6.1 Alternative 1 – Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)

Under this alternative, methods viewed by some persons as inhumane would continue to be used in BDM by WS. Some people would view methods employed to capture and/or kill hazardous bird for safety purposes and the protection of property as inhumane. Humaneness, as it relates to the killing or capturing of birds is an important but complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. However, humaneness as it relates to the natural world through natural mortality versus man-induced mortality must be brought into perspective. DeVos and Smith (1995) explain the characteristics of natural mortality in wildlife populations. There seems to be an increasing public perception that, left alone by humans, animal populations will experience few premature deaths and live to an old age without harm, pain or suffering. It should be recognized that bird populations reproduce at far greater rates than would be necessary to replace deaths if all lived to old age. To counterbalance this high reproduction, it is natural for most individuals of most species to die young, often before reaching breeding age. Natural mortality in bird populations includes predation, malnutrition, disease, inclement weather, and accidents. These "natural" deaths are often greater in frequency than human-caused deaths through regulated hunting, trapping, and bird damage management operations. From the standpoint of the bird, these natural mortality factors also may cause more suffering by birds, as perceived by humans, than human-induced mortality. Under given habitat conditions, most bird populations fluctuate around a rather specific density, sometimes called the carrying capacity. Populations that overshoot this density via reproduction become very sensitive to various sources of mortality, and death rates increase. Conversely, as populations drop, mortality rates decline (DeVos and Smith 1995). Thus, human-induced mortality - which often involves much less suffering of individual birds - invariably lessens mortality from other sources.

Research suggests that with some methods, such as restraint in traps, changes in the blood chemistry of trapped birds indicate "stress." However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness. The challenge in coping with this issue is how to achieve the least amount of bird suffering with the constraints imposed by current technology. To insure the most professional handling of these issues and concerns, APHIS-WS has policies giving direction toward the achievement of the most humane program possible while still accomplishing the program's mission.

APHIS-WS has improved the selectivity of management devices through research and development of pan-tension devices and other device modifications such as breakaway snares. Research is continuing with the goal of bringing new findings and products into practical use. Until such time as new findings and products are found to be practical, some animal suffering will occur during lethal collection of animal specimens if monitoring and program effectiveness objectives are to be met. APHIS-WS has also improved the humaneness of current management devices through the incorporation of veterinary medical tranquilizers, immobilizers, and euthanizing agents.

BDM methods would include shooting, lethal trapping, and toxicants/chemicals such as immobilizing and euthanizing drugs, DRC-1339, and Avitrol. Shooting, when performed by experienced professionals, usually results in a quick death for target animals. Occasionally, however, some birds are initially wounded and must be shot a second time or must be caught by hand and then euthanized. Some persons would view shooting as inhumane. Despite SOP's designed to maximize humaneness, as described in sections 3.4.1, the perceived stress and trauma associated with being held in traps until the WS specialist arrives to euthanize the animal, is unacceptable to some persons. Other lethal BDM methods used to take target birds include body-gripping traps (i.e., snap traps). These traps result in a relatively humane death because the birds die instantly or within seconds to a few minutes. The primary lethal bird chemical BDM method that would be used by WS under this alternative would be DRC-1339. This chemical causes a quiet and apparently painless death that result from uremic poisoning and congestion of major organs (Decino et al. 1966). The birds become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. This method appears to result in a less stressful death than which probably occurs by most natural causes; which are primarily disease, starvation, and predation. For these reasons, WS considers DRC-1339 use under the current program to be a relatively humane method of lethal BDM. However, despite the apparent painlessness of the effects of this chemical, some persons will view any method that takes a number of hours to cause death as inhumane and unacceptable. The chemical Avitrol repels birds by poisoning a few members of a flock, causing them to become hyperactive (see discussion in Appendix B). Their distress calls generally alarm the other birds and cause them to leave the site. Only a small number of birds need to be affected to cause alarm in the rest of the flock. The affected birds generally die. Some persons would view Avitrol as inhumane treatment of the affected birds, based on the birds' distress behaviors. Occasionally, birds captured alive by traps, by hand or with nets would be euthanized. The most common method of euthanization would be cervical dislocation and by CO_2 gas which are AVMA-approved euthanasia methods (Beaver et al 2001). Most people would view AVMA-approved euthanization methods as humane.

4.1.6.2 Alternative 2 – Non-lethal BDM only, by WS

Under this alternative, WS would not use lethal methods viewed as inhumane by some persons. However, property managers may reject non-lethal BDM recommended and provided by WS and would seek alternative lethal means resulting in impacts to humaneness similar to or greater than the proposed action. Impacts of lethal methods implemented by non-WS employees could be similar or greater than the proposed action depending upon their BDM training and experience. Since DRC-1339 would not be available to non-WS entities, the only chemical bird BDM method that could be legally used by these entities would be Avitrol. Avitrol would most likely be viewed as less humane than DRC-1339 because of the distress behaviors that it causes. Unless the property contracts for the services of a licensed veterinarian, the use of State and federally controlled capture/euthanasia chemicals would be illegal. Overall, people who perceive the use of lethal control methods by WS as inhumane would prefer this alternative to the proposed action.

4.1.6.3 Alternative 3 - Lethal BDM only, by WS

Under this alternative, only lethal BDM activities would be implemented or recommended. These methods

would include shooting, trapping, and the use of toxicants/chemicals that may be viewed by some persons as inhumane. Impacts for this alternative would be similar to the proposed action.

4.1.6.4 Alternative 4 - No Federal WS BDM

Under this alternative, lethal methods viewed as inhumane by some persons would not be used or recommended by WS. Similar to Alternative 2, DRC-1339 or other WS accessible chemicals would no longer be available for use. Thus, the only chemical bird BDM method legally available would be Avitrol which would be viewed by many persons as less humane than DRC-1339. Unless the property contracts for the services of a licensed veterinarian, the use of State and federally controlled capture/euthanasia chemicals would be illegal. Shooting, and BDM trapping and capture methods could be used by non-WS entities and, similar to the current program alternative, would be viewed by some persons as inhumane. Overall, it is likely that BDM would be similar or somewhat less humane with this alternative than under the proposed action, dependent upon the training and expertise of the person implementing control methods.

4.2 Cumulative Impacts

No significant cumulative environmental impacts are expected from any of the 4 alternatives. Under the Proposed Action and Alternative 3, the lethal removal of birds would not have a significant impact on overall wild bird populations in Indiana, but some local reductions may occur. This is supported by the IDNR, which is the agency with responsibility for managing wildlife in the State (IDNR 2001). No risk to public safety is expected when WS' services are provided and accepted by requesting individuals in Alternatives 1, 2, and 3, since only trained and experienced wildlife biologists/specialists would conduct and recommend BDM activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 1, 2 and 3 conduct BDM activities, and when no WS assistance is provided in Alternative 4. In all 4 Alternatives, however, it would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS' participation in BDM activities to protect property and human health and safety at municipalities, industrial sites, agricultural sites, and private land within Indiana, the analysis in this EA indicates that WS Integrated BDM program will not result in significant cumulative adverse impacts on the quality of the human environment. Table 4-1 Summarizes the expected impact of each of the alternatives on each of the issues.

Table 4-1. Summary of Environmental Consequences

Issues/Methods	**Alternative 1 – Implement a Federal Bird Damage Management Program/IBDM (Proposed Action/No Action)**	**Alternative 2 – Non-lethal BDM Only, by WS**	**Alternative 3- Lethal BDM Only, by WS**	**Alternative 4 - No Federal WS BDM**
Effects on Target Bird Species Populations	Local populations in areas with damage or threat of damage would be reduce and sustained at a lower level. No effects on state populations.	Results may equal or be less than the proposed action.	Local populations in areas with damage or threat of damage would be reduced and sustained at a lower level. No effects on state populations	If municipalities, industrial sites, agricultural sites, and private land within Indiana conduct their own management without WS, results could be similar or

				greater on population reduction. If not populations and threats would remain the same or increase.
Effects on Non-target Species Populations, including T&E Species	No probable effect.	No probable effect. If any property chose to conduct lethal removal without WS, non-targets species maybe taken.	No probable effect.	If any property conducts lethal BDM, non-target species may be taken.
Effects on Human Health and Safety	The proposed action has the greatest potential of successfully reducing this risk	Impacts on Human Safety could be greater under this alternative than the proposed action.	Impacts on Human Safety could be greater under this alternative than the proposed action.	Property efforts to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater potential of not reducing bird damage than under the proposed action.
Effects on Aesthetics	Variable. Properties who are receiving damage would favor this alternative. Some activists would oppose this alternative.	Variable. Activists would favor this alternative; however, municipalities, industrial sites, agricultural sites, and private land within Indiana would probable impose their own lethal control, resulting in a larger take.	Since WS could not use non-lethal methods, the impacts of this alternative would be greater that the proposed action. Some activists would oppose this alternative.	Property managers would likely conduct similar BDM activities no longer conducted by WS, resulting in impacts similar to the current program alternative.
Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS	Some people will view as inhumane. Others will view as more humane than alternative 3. Most people would view AVMA approved euthanization methods as humane.	People who perceive the use of lethal control methods by WS as inhumane would prefer this alternative to the proposed action.	Impacts for this alternative would be similar to the proposed action.	Property owners/managers would likely implement a similar BDM plan, and results would likely be similar or somewhat less humane with this alternative than under the proposed action.

Appendix A

Literature Cited

AAWV (American Association of Wildlife Veterinarians). Undated. *wildvet@gomontana.com*

Allan J. R., J. S. Kirby, and C.J. Feare. 1995. The biology of Canada geese *Branta canadensis* in relation to the management of feral populations. Wildl. Bio. 1:129-143.

AVMA (American Veterinary Medical Association). 1987. Journal of the American Veterinary Medical Association. Panel Report on the Colloquim on Recognition and Alleviation of Animal Pain an Distress. 191:1186-1189.

Arhart, D.K. 1972. Some factors that influence the response of starlings to aversive visual stimuli. M.S. Thesis. Oregon State University Corvallis.

Avery, M.L., J.S. Humphrey, E.A. Tillman, K.O. Pares, and J.E. Hatcher. 2002. Dispersing vulture roosts on communication towers. J. of Raptor Research 36:44-49.

Avery, M.L., J.S. Humphrey, and D.G. Decker. 1997. Feeding deterrence of anthraquinone, anthracene, and anthrone to rice-eating birds. J. Wildl. Manage. 61(4):1359-1365.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B. T. Bennett, P. Pascoe, E. Shull, L.C. Cork, R. Francis-Floyd, K.D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G.W. Thorton, and B. Kohn. 2001. 2000 Report of the AVMA panel on euthanasia. Journal of the American Veterinary Medical Association 218:669-696.

Bedard, J. and Gauthier, G. 1986. Assessment of fecal output in geese. J. Appl. Ecol. 23:77-90.

Belant, J. L. 1993. Nest-site selection and reproductive biology of roof- and island-nesting herring gulls. Transactions of the North American Wildlife Natural Resources Conference 58:78-86.

Berryman, J. H. 1991. Animal damage management: responsibilities or various agencies and the need for coordination and support. Proc. East. Wildl. Damage Control Conf. 5:12-14.

Besser, J.F., W. C. Royal, and J. W. DeGrazio. 1967. Baiting starlings with DRC-1339 at a cattle feedlot. J. Wildl. Manage. 3:48-51.

_____, J. W. DeGrazio, and J.L. Guarino. 1968. Costs of wintering European starlings and red-winged blackbirds at feedlots. Journal of Wildl. Manage. 32:179-180.

Bishop, R. C. 1987. Economic values defined. Pages 24 -33 *in* D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, CO. 424 p.

Blackwell, B.F., G.E. Bernhardt, R.A. Dolbeer. 2002. Lasers as nonlethal avian repellents. J. Wildl. Manage. 66:250-258.

Blandespoor, H.D. and R.L. Reimink. 1991. The control of swimmer's itch in Michigan: past, present and future. Michigan Academ. XXIV, 7-23.

Blanton, E. M., B. U. Constantin, and G. L. Williams. 1992. Efficacy and methodology of urban pigeon control with DRC-1339. Proc. East. Wildl. Damage Cont. Conf. 5:58-62.

Blokpoel, H. 1976. Bird Hazards to Aircraft. Books Canada Inc. Buffalo, NY. p. 236.

Blokpoel, H. and W. C. Scharf. 1991a. The ring-billed gull in the Great Lakes of North America. Acta Congress of International Ornithology 20:2372-2377.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring starlings. Wild. Soc. Bull. 18:(2):151-156.

Bookhout, T.A. and S.B. White. 1981. Blackbird and Starling roosting dynamics: implications for animal damage control. Proc. Bird Control Semin. 8:215-221.

Butterfield, J., J. C. Coulson, S. V. Kearsey, P. Monaghan, J. H. McCoy, and G. E. Spain. 1983. The herring gull, *Larus argentatus*, as a carrier of *salmonella*. Journal of Hyg., Camb. 91:429-436.

CDCP (Centers for Disease Control and Prevention). 1998. Cryptosporidiosis: Fact Sheet. Nat. Center for Infect. Dis., Div. Paras. Dis. 3 p.

CDCP (Centers for Disease Control and Prevention). 1999. Giardiasis: Fact Sheet. Nat. Center for Infect. Dis., Div. Paras. Dis. 5pp.

CDFG (California Department of Fish and Game). 1991. California department of fish and game. Final environmental document - bear hunting. Sections 265, 365, 366, 367, 367.5. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 13pp.

Clark, L. 1997. Dermal contact repellents for starlings: foot exposure to natural plant products. J. Wildl. Manage. 61(4): 1352-1358.

Cleary, E.C., S.E. Wright, and R.A. Dolbeer. 1999. Wildlife strikes to civil aircraft in the United States, 1991-1997. Federal Aviation Administration (FAA), Office of Airport Safety and Standards, Washington, D.C.

Code of Federal Regulations (CFR). 1995. Chapter 1 Wildlife and Fisheries. Part 21 Subpart D. P371. Office of the Federal Register. U.S. Government Printing Office. Washington D.C.

Colley, D. G. 1996. Waterborne Cryptosporidiosis threat addressed. Centers for Disease Control and Prevention. Atlanta, GA. http://www.cdc.gov/ncidod/EID/vol1no2/colley.htm

Conover, M. R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc. Wildl.-Livestock Relation. Sym. 10:332-344.

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1981. DRC-1339 and DRC-2698 residues in starlings: preliminary evaluation of their effects on secondary hazard potential. Proc. Bird Control Semin. 8:31-37.

Decino, T.J., D.J. Cunningham, and E.W. Schafer. 1966. Toxicity of DRC-1339 to starlings. J. Wildl.\ Manage. 30(2):249-253.

Decker, D. J., and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, p. 424.

DeVos, Jr., J.C. and J.L. Smith. 1995. Natural mortality in wildlife populations. Proactive Strategies Committee

Report #1. Proactive Strategies Project of the International Association of Fish and Wildlife Agencies and Arizona Game and Fish Department.

Dolbeer, R.A., J.L. Belant, and L. Clark. 1993. Methyl anthranilate formulations to repel birds form water at airports and food at landfills. Proc. Great Plains Wildl. Damage Contr. Workshop. 11:42-52.

Dolbeer, R.A., C.R. Ingram, and J.L. Seubert. 1976. Modeling as a management tool for assessing the impact of blackbird control measures. Proc. Vertebr. Pest Conf. 7:35-45.

_____ and R. A. Stehn. 1979. Population trends of blackbirds and starlings in North America, 1966-1976. U.S. Fish Wild. Serv. Spec. Sci. Rep. 214.

_____ , L. Clark, P.P. Woronecki, and T.W. Seamans. 1992. Pen tests of methyl anthranilate as a bird repellent in water. Proc. East. Wildl. Damage Control Conf. 5:112-116.

_____, P.P. Woronecki, and R.L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildl. Soc. Bull. 14:418-425.

_____, T.W. Seamans, B.F. Blackwell, J.L. Belant. 1998. Anthraquinone formulation (Flight Control™) shows promise as avian feeding repellent. J. Wildl. Manage. 62(4)1558-1564.

_____, R.A. 1994. Blackbirds: damage prevention and control methods for blackbirds. pp E-25 to E-32 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson (eds.) Prevention and Control of Wildlife Damage. Univ. Nebraska and USDA-APHIS-WS and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

_____, Richard A.; Woronecki, Paul P.; Stickley, Allen R., Jr. and White, Stephen B. 1978. Agricultural impact of winter population of blackbirds and starlings. Wilson Bull.:90 (1): 31_44.

EPA (U.S. Environmental Protection Agency). 1995. R.E.D. Facts _ Starlicide (3-chloro-p-toluidine hydrochloride). USEPA, Prevention, Pesticides and Toxic Substances. EPA-738-F-96-003. 4 p.

EPA (U.S. Environmental Protection Agency). 1997. 4-Aminopyridine. Health Assessment Information. Taken from USEPA IRIS data file No. 504-24-5 (03/01/97) at Internet site http://www.epa.gov/ngispgm3/irisdat/0440.DAT

ETOXNET (Extension Toxicology Network). 1996. 4-Aminopyridine. Pesticide Information Profiles. Coop. Ext. Offices at Cornell Univ., OR State Univ., Univ. of ID, Univ. of CA-Davis, and the Instit. for Envir. Toxicology, MI State Univ. Information taken from Internet site http://ace.ace.orst.edu/info/extoxnet/pips/4-aminop.htm.

Feare, C., A.J. Isaacson, P.A. Sheppard, and J.M. Hogan. 1981. Attempts to reduce starling damage at dairy farms. Protection Ecol. 3(2):173-181.

Feare, C. 1984. The Starling. Oxford University Press. Oxford New York.

Fenlon, D. R. 1981. Seagulls (*Larus* spp.) as vectors of salmonellae: an investigation into the range of serotypes and numbers of salmonellae in gull faeces. Journal of Hyg., Camb. 86:195-202.

Fitzwater, W.D. 1994. House Sparrows. pp E-101 to E-108 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson (eds.) Prevention and Control of Wildlife Damage. Univ. Nebraska and USDA-APHIS-WS and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Forbes, J.E. 1995. European starlings are expensive nuisance on dairy farms. Ag. Impact. 17(1):4.

Friedman, H. 1929. The cowbirds. Charles C. Thoman, Pub., Baltimore. 421pp.

Fuller-Perrine, L.D. and M.E. Tobin. 1993. A method for applying and removing bird exclusion netting in commercial vineyards. Wildl. Soc. Bull. 21:47-51.

Gallien, P. and M. Hartung. 1994. Escherichia coli O157:H7 as a food borne pathogen. Pp. 331_341 *in* Handbook of zoonoses. Section A: bacterial, rickettsial, chlamydial, and mycotic. G. W. Beran and J. H. Steele, eds. CRC Press. Boca Raton.

Glahn, J.F. 1982. Use of starlicide to reduce starling damage at livestock feeding operations. Proc. Great Plains Wildl. Damage Control Workshop. 5:273-277.

_____ . 1983. Blackbird and starling depredations at Tennessee livestock farms. Proc. Bird Control Semin. 9:125-134.

_____, S.K. Timbrook, and D.J. Twedt. 1987. Temporal use patterns of wintering starlings at a southeastern livestock farm: implications for damage control. Proc. East. Wildl. Damage Control Conf. 3:194-203.

_____., and E. A. Wilson. 1992. Effectiveness of DRC-1339 baiting for reducing blackbird damage to sprouting rice. Proc. East. Wildl. Damage Cont. Conf. 5:117-123.

_____ , and D.L. Otis. 1986. Factors influencing blackbird and European starling damage at livestock feeding operations. J. Wildl. Manage. 50:15-19.

_____, J.F., G. Ellis, P. Fiornelli, and B. Dorr. 2000. Evaluation of low to moderate power lasers for dispering double-crested cormorants from their night roosts. Proceedings of the 9th Wildlife Damage Management Conference. 9:34-35.

Graczyk, T. K., R. Fayer, J. M. Trout, E. J. Lewis, C. A. Farley, I. Sulaiman, and A. A. Lal. 1998. *Giardia sp.* Cysts and infections *Cryptosporidium parvum* oocysts in the feces of migratory Canada geese. Appl. Environ. Microbiol. 64:2737-2738.

Graczyk, T. K., M. R. Cranfield, R. Fayer, J. Tout, and J. J. Goodale. 1997. Infectivity of *Cryptosporidium parvum* oocysts is retained upon intestinal passage through a migratory waterfowl species (Canada goose, *Branta canadnsis*). Tropical Med. International Heal. 2(4):341-347.

Graves, G. E., and W. F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ex. Serv. Publ. no 6.516. Ft. Collins, Colo. 2 pp.

Harris, H. J., J. A. Ladowski, and D. J. Worden. 1981. Water_quality problems and management of an urban waterfowl sanctuary. J. of Wildl. Manage. 45: 501-507.

Hatch, J. J. 1996. Threats to public health from gulls (Laridae). Journal of Environmental Health Research 6:5-16.

Hill, G. A. and D. J. Grimes. 1984. Seasonal study of a freshwater lake and migratory waterfowl for *Campylobacter jejuni*. Can. J. Microbiol. 30:845-849.

Hygnstrom, S. E., and S. R. Craven. 1994. Hawks and owls. pp. E53-62 *in* Prevention and control of wildlife damage. S. Hygnstrom, R. Timm, and G. Larson eds. Coop. Ext. Serv. Univ. of Nebr.-Lincoln

Heusmann, H.W., and R. Bellville. 1978. Effects of nest removal on starling populations. Wilson Bull. 90(2):287-290.

Hussong, D., J.M. Damare, R.J. Limpert, W.J.L. Sladen, R.M. Weiner, and R.R. Colwell. 1979. Mocrobial impact of Canada Geese (*Branta canadensis*) and whistling swans (*Cygnus columbianus columbianus*) on aquatic ecosystems. Appl. Envir. Microb. 37:14-20.

Indiana Department of Natural Resources, World wide Web site (http://www.dnr.state.in.us)

Jamieson, R. L. 1998. Tests show Canada geese are cause of polluted lake water. Seattle Pilot. July 9. Seattle, WA.

Johnson, R.J., and J.F. Glahn. 1994. European Starlings. p. E-109 - E-120 in Hygnstrom, S.E., R.M. Timm, and G.E. Larson, Prevention and control of wildlife damage - 1994. Univ. NE Coop. Ext., Instit. o f Ag. and Nat. Res., Univ. of NE-Lincoln, USDA, APHIS, ADC, Great Plains Ag. Council Wildl. Committee.

Jones, F., P. Smith, and D. C. Watson. 1978. Pollution of a water supply catchment by breeding gulls and the potential environmental health implications. Journal of the Institute of Water Engineering Science 32:469-482.

Kitchell, J. F., D. E. Schindler, B.R. Herwig, D. M. Post, and M. H. Olson. 1999. Nutrient cycling at the landscape scale: The role of diel foraging migrations by geese at the Bosque del Apache National Wildlife Refuge, New Mexico, Liminol. Oceanog. 44: 828-836.

Klett, B. R., D. F. Parkhurst, and F. R. Gaines. 1998. The Kensico Watershed Study: 1993-1995. http://www.epa.gov/owowwtrl/watershed/Proceed/klett.html

Leopold, A. S. 1933. Game Management. Charles Scribner & Sons. NY, NY. 481 p.

Locke, L. N. 1987. Chlamydiosis. Pp. 107-113 *in* Field Guide to Wildlife Diseases. M. Friend and C. J. Laitman editors. 225 p.

Lovell, H.B. 1947. Black vultures kill young pigs in Kentucky. Auk 64:131-132.

Lovell, H.B. 1952. Black vulture depredations at Kentucky woodlands. Auk 64:48-49.

Lowney, M.S. 1999. Damage by black and turkey vultures in Virginia, 1990-1996. Wildl. Soc. Bull. 27:715-719.

Luechtefeld, N. W.,M. J. Blaser, L. B. Reller, and W. L. L. Wang. 1980. Isolation of *Campylobacter fetus* subsp. *Jejuni* from migratory waterfowl. J. Clin. Microbiol. 12:406-408.

Manny, B.A., W.C. Johnson, and R.G. Wetzel. 1994. Nutrient additions by waterfowl to lakes and reservoirs: predicting their effects on productivity and water quality. Hydrobiologoia. 279/280: 121-132.

McCracken H.F. 1972. Starling control in Sonoma County. Proc. Vertebr. Pest Conf. 5:124-126.

MacDonald, J. W. and P. D. Brown. 1974. *Salmonella* infection in wild birds in Britain. Veterinary Record 94:321-322.

Mason, J.R.,, A. H. Arzt, and R.F. Reidinger. 1984. Evaluation of dimethylanthranilate as a nontoxic starling repellent for feedlot settings. Proc. East. Wildl. Damage Control Conf. 1:259-263.

_____, M.A. Adams, and L. Clark. 1989. Anthranilate repellency to starlings: chemical correlates and sensory perception. J. Wildl. Manage. 53:55-64.

Meanley, B. and W. C. Royall. 1976. Nationwide estimates of blackbirds and starlings. Proc. Bird Control Seminar. 7:39-40.

Miller, J.W. 1975. Much ado about starlings. Nat. Hist. 84(7):38-45

Miller, M. 2001. 1999-2000 Canada Goose Harvest Summary. Indiana Division of Fish and Wildlife.

Mills, C.E. 2001. Survey and Management of Interior Least Terns in Indiana-2001. Indiana Division of Fish and Wildlife.

Monaghan, P., C. B. Shedden, C. R. Fricker, and R. W. A. Girdwood. 1985. Salmonella carriage by herring gulls in the Clyde area of Scotland in relation to their feeding ecology. Journal of Applied Ecology 22:669-680.

Mott. D.F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proc. East. Wildl. Damage Conf. 2:156-162.

Mumford, R.E., and J.O. Whitaker Jr. 1984. Mammals of Indiana. Indiana University Press. Bloomington, IN. p. 370-380.

Mumford, R.E. The Birds of Indiana. 1982. Indiana University Press. Bloomington, IN. p. 113-114.

Norton, R. L. 1986. Case of botulism in laughing gulls at a landfill in the Virgin Islands, Greater Antilles. Florida Field Naturalist 14:97-98.

Pacha, R. E., G. W. Clark, E. A. Williams, and A. M. Carter. 1988. Migratory birds of central Washington as reservoirs of *Campylobacter jejuni.* Can. J. Micro. 34:80-82.

Parmalee, P.W. 1954. The vultures: their movements, economic status, and control in Texas. Auk 71:443-453.

Pochop, P.A. 1998. Comparison of white mineral oil and corn oil to reduce hatchability of ring-billed gull eggs. Proc. Vertebr. Pest Conf. 18:411-413.

_____, J.L. Cummings, J.E. Steuber, and C.A. Yoder. 1998. Effectiveness of several oils to reduce hatchability of chicken eggs. J. Wildl. Manage. 62(1):395-398.

Quessey, S. and S. Messier. 1992. Prevalence of *Salmonella* spp., *Campylobacter* spp. and *Listeria* spp. in ring-billed gulls (*Larus delawarensis*). Journal of Wildlife Disease 28:526-531.

Reilly, W. G., G. I. Forbes, G. M. Paterson, and J. C. M. Sharp. 1981. Human and animal salmonellosis in Scotland associated with environmental contamination., 1973-1979. Veterinary Record 108:553-555.

RJ Advantage, Inc. 1997.

Roads, K.M. 1936. Black vultures kill and eat new-born lambs. Wilson Bulletin 28:219.

Roffe, T. J. 1987. Avian tuberculosis. Pp 95_99 *in* Field guide to wildlife diseases. M. Friend and C. J. Laitman editors. 225p.

Roscoe, D. E. 1999. A survey to estimate the prevalence of *Salmonella* sp., *Shigella* sp., *Yersinia* sp. bacteria and

Cryptosporidia sp., *Giardia* sp. protozoa in resident Canada geese (*Branta canadensis*) in New Jersey. Project Report. NJ Division of Fish and Wildlife. 13 pp.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving starlings from their sleeping areas. Emberiza 2(3):176-179.

Royall, W. C. 1977. Blackbird-Starling Roost Survey. Bird Damage Research Report #52. Denver Wildlife Research Center. 54pp.

Royall, W. C. , T.J. DeCino, and J.F. Besser. 1967. Reduction of a Starling Population at a Turkey Farm. Poultry Science. Vol. XLVI No. 6. pp 1494-1495.

Saltoun, C.A., K.E. Harris, T.L. Mathisen, and R. Patterson. 2000. Hypersensitivity pneumonitis resulting from community exposure to Canada goose droppings: when an external environmental antigen becomes an indoor environmental antigen. Annal. Allergy Asth. Immun. 84:84-86.

Sauer, J.R., J.E. Hines, and J. Fallon. 2001. The North American breeding bird survey, results and analysis 1966 – 2000. Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD.

Scherer, N. M., H. L. Gibbons, and M. Mueller. Undated. Nutrient loading of an urban lake by bird feces. KCM, Inc. Seattle, WA. 16pp.

Schmidt, R. H. 1989. Animal welfare and wildlife management. Trans. N. A. Wildl. And Nat. Res. Conf. 54:468-475

Schmidt, R.H. and R.J. Johnson. 1984. Bird dispersal recordings: an overview. ASTM STP 817. 4:43-65.

Shirota, Y.M. and S. Masake. 1983. Eyespotted balloons are a device to scare gray starlings. Appl. Ent. Zool. 18:545-549.

Simmons, G. M., S. A. Herbein, and C. M. James. 1995. Managing nonpoint fecal coliform sources to tidal inlets. Water Resources Update. 100:64-74.

Slate, D.A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. Trans. N. A. Wildl. Nat. Res. Conf 57:51-62.

Smith, K. E., J. R. Fischer, S. E. Little, J. M. Lockhart, and D. E. Stallknecht. 1997. Diseases with implication for human health. Pages 378_399 *in* Field Manual of Wildlife Diseases in the Southeastern United States. W. R. Davidson and V. F. Nettles, eds. Univ. of GA. Athens, GA.

Sprunt, A. 1946. Predation on living prey by the black vulture. Auk 63:260-62.

Sterritt, R. M. and J. N. Lester. 1988. Microbiology for environmental and public health engineers. E. & F. N. Spon, pub. New York.

Stroud, R. K. and M. Friend. 1987. Salmonellosis. Pp 101_106 *in* Field Guide to Wildlife Diseases. M. Friend and D. J. Laitman editors. 225 p.

Tillman, E.A., J.S. Humphrey, and M.L. Avery. 2002. Use of vulture carcasses and effigies to reduce vulture damage to property and agriculture. Proc. Vert. Pest Conf. 20:in press.

Twedt, D.J., and J.F. Glahn. 1982. Reducing starling depredations at livestock feeding operations through changes in management practices. Proc. Vertebr. Pest Conf. 10:159-163.

Tobin, M. E., P. P. Woronecki, R. A. Dolbeer, R. L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildl. Soc. Bull. 16:300-303.

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS). 2002. Environmental Assessment for Wildlife Damage Management at Airports in Indiana. USDA, APHIS, WS-IN, Smith Hall, Purdue University, 901 W. State St., West Lafayette, IN 47907-2054.

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC) Strategic Plan. 1989. USDA, APHIS, ADC Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS). 1998. Managing Wildlife Hazards at Airports. USDA, APHIS, WS Operational Support Staff, 4700 River Road, Unit 87, Riverdale MD 20737.

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) Field Operations Manual for the Use of Immobilizing and Euthanizing Drugs. Johnson, M.R. et al. June 2001.

USDA, APHIS, WS Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS),Wildlife Services (WS), Indiana World wide Web site (http://www.entm.purdue.edu/wildlife/wild.htm)

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Animal Damage Control Program. 1997j. Final Environmental Impact Statement - revised October 1997. USDA, APHIS, Wildlife Services Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

U.S. Geological Survey. 2000. Screening for potential human pathogens in fecal material deposited by resident Canada geese on areas of public utility. Completion report. National Wildlife Health Center, Madison, WI. 28 pp.

Vauk-Hentzelt, E., W. Gunkel, and K. Klings. 1987. Microbial diseases in special consideration of Coli septicaemia Escherichia coli of gulls Laridae around the Isle Helgoland (German Bight). In: Global Trends in Wildlife Management, 18th IUGB Congress, Krakow, Poland, August, 1987. Swait Press, Krakow. P. 273-275.

Vermeer, K., D. Power, and G. E. J. Smith. 1988. Habitat selection and nesting biology of roof-nesting glaucous winged gulls. Colonial Waterbirds 11:189-201.

Virginia Department of Health. 1995. Cryptosporidium: Fact Sheet. Pub. No. FS-DWSE-95-1. Richmond, VA. 3.

Weber, W.J. 1979. Health hazards from pigeons, starlings, and English sparrows. Thomson Pub. Fresno, CA 138 pp.

Weeks, R. J., and Stickley, A. R. 1984. Histoplasmosis and its relation to bird roosts: a review. Denver Wildl. Res. Ctr. Bird Damage Rpt. No. 330. U.S. Fish and Wildl. Serv. 23pp.

West, R.R., J.F. Besser and J.W. DeGrazio. 1967. Starling control in livestock feeding areas. Proc. Vertebr. Pest Conf. San Francisco, CA.

West, R.R. and J.F. Besser. 1976. Selection of toxic poultry pellets from cattle rations by starlings. Proc. Bird Control Semin. 7:242-244.

Williams, R. E. 1983. Integrated management of wintering blackbirds and their economic impact at south Texas feedlots. Ph.D. Dissertation, Tex. A&M Univ., College Station. 282 pp.

Williams, D.E. and R.M. Corrigan. 1994. Pigeons (Rock Doves) p. E-87 - E-96 in Hygnstrom, S.E., R.M. Timm, and G.E. Larson, Prevention and control of wildlife damage - 1994. Univ. NE Coop. Ext., Instit. o f Ag. and Nat. Res., Univ. of NE-Lincoln, USDA, APHIS, ADC, Great Plains Ag. Council Wildl. Committee.

Wildlife Society, The. 1990. Conservation policies of the Wildlife Society. The Wildlife Society. Wash., D.C. 20 p.

Wobeser, G. and C. J. Brand. 1982. Chlamysiosis in 2 biologists investigating disease occurrences in wild waterfowl. Wildl. Soc. Bull. 10:170-172.

Woronecki, P. P., R. A. Dolbeer, and T. W. Seamans. 1990. Use of alpha-chloralose to remove waterfowl from nuisance and damage situations. Proc. Vertbr. Pest Conf. 14:343-349.

Wright, E.N. 1973. Experiments to control starling damage at intensive animal husbandry units. Bull. OEPP. 9:85-89.

Appendix B

BIRD DAMAGE MANAGEMENT (BDM) METHODS AVAILABLE FOR USE OR RECOMMENDATIONS BY THE INDIANA WILDLIFE SERVICES PROGRAM

NONLETHAL METHODS-NONCHEMICAL

Property owner practices. These consist primarily of non-lethal preventive methods such as cultural methods and habitat modification. Property management or the property owner implements cultural methods and other management techniques. Resource owners/managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practically. These methods include:

Environmental/Habitat modification can be an integral part of BDM. Bird production and/or presence are directly related to the type, quality and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain bird species. Municipalities, industrial sites, agricultural sites, and private land within Indiana are responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of BDM strategies at or near the aforementioned sites to reduce problems by eliminating nesting, roosting, loafing and feeding sites.

Bird Behavior Modification. This refers to tactics that alter the behavior of birds to reduce damage. Bird behavior modification may involve us of scare tactics or barriers to deter or repel birds that cause loss or damage (Twedt and Glahn 1982). Some but not all methods are included in this category are:

Bird-proof barriers
Propane cannons
Pryotechnics
Distress Calls and sound producing devices
Chemical frightening agents
Repellents
Harassment with a radio controlled plane
Mylar tape

These methods are generally only practical for small area. Scaring devices such as distress calls, propane cannons, raptor effigies and silhouettes, mirrors and moving disks can be effective but usually for only a short time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Graves and Andelt 1987, Mott 1985, Shirota et al. 1983, Conover 1982, Arhart 1972).

Bird-proof barriers can be effective but often are cost-prohibitive, particularly because of the aerial mobility of, which requires overhead barriers as well as peripheral fencing or netting. Buildings could be “bird proofed” using hardware cloth or netting, where feasible, to eliminate roosting and nesting areas. Porcupine wire (e.g., Nixalite™, Catclaw™) is a mechanical repellent method that can be used to exclude pigeons and other bird from ledges and other roosting surfaces (Williams and Coorigan 1994). The sharp points inflict temporary discomfort on the birds as they try to land, which deters them from roosting. Drawbacks of this method are that some pigeons have been know to build nests on top of porcupine wires and the method can be expensive to implement if large areas are involved. Electric shock bird control systems are available from commercial sources and, although expensive, can be effective in deterring pigeons and other birds from roosting on ledges, window sills and other similar portions of structures (Williams and Corrigan 1994).

Auditory scaring devices such as propane cannons, pyrotechnics, electronic guards, sirens, scarecrows, and audio

distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species. These devices are sometimes effective but usually only for a short period of time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Mott 1985, Shirota et.al. 1983, and Arhart 1972). These methods should be reinforced with other scaring devices such as shooting and other types of physical harassment.

Visual techniques such as use of mylar tape (highly reflective surface produces flashes of light that startles birds), eye-spot balloons (the large eyes supposedly gives birds a visual cue that a large predator is present), flags, effigies (scarecrows), sometimes are effective in reducing bird damage. Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et.al 1986, and Tobin et.al. 1998). Birds quickly learn to ignore visual and other scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Physical harassment by radio controlled airplanes are effective in several situations for dispersing damage-causing birds. This tool is effective in removing raptors from areas that are not accessible by other means. Radio controlled airplanes allow for up close and personal harassment of birds, while combining visual (eyespots painted on the wings) and auditory (engine noise and whistles attached to the aircraft) scare devices. Disadvantages of this method are birds in large flocks do not respond well to the plane, training is required to become efficient, weather conditions may restrict the ability/usefulness of the plane, and mechanical up keep.

Relocation of damaging birds to other areas following live capture generally would not be effective nor cost-effective. Relocation to other areas following live capture would not generally be effective because problem bird species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and relocation would most likely result in bird damage problems at the new location. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats.

However, there are exceptions for the relocation of damaging birds that might be a viable solution and acceptable to the public when the birds were considered to have high value such as migratory waterfowl, raptors, or T&E species. In these cases, WS would consult with the USFWS and/or IDNR to coordinate capture, transportation, and selection of suitable relocation sites, as well as compliance with all proper guidelines.

Effigies can be used to disperse vulture roosts and protect property (Avery et al. 2002, Tilman et al. 2002). Effigies can be dead vultures, taxidermy vultures, or modified plastic goose decoys painted to resemble vultures (Humphrey et al. 2001, Avery et al. 2002, Tillman et al. 2002). Effigies are hung upside down as high as possible in roost trees or from specially constructed masts to disperse vultures (Humphrey et al. 2001, Tillman et al. 2002). A migratory bird permit is required from the USFWS before a vulture may be taken to use as an effigy or to salvage a dead vulture (e.g., road killed bird) to use as an effigy.

Lasers are a non-lethal technique recently evaluated by the USDA, APHIS, WS, National Wildlife Research Center (NWRC) to disperse double-crested cormorant roosts (Glahn et al. 2000). For best results and to disperse numerous birds from a roost, the laser is most effectively used in periods of low light, such as after sunset and before sunrise. In the daytime, the laser can also be used during overcast conditions or in shaded areas to move individual and small numbers of birds, although the effective range of the laser is much diminished. Moving the laser light through the tree branches rather than touching birds with the laser light elicited an avoidance response from cormorants (Glahn et al. 2000). During pen trials with lasers the cormorants were inconsistent in their response with some birds showing no response to the laser (Glahn et al. 2000). The lack of overt response by cormorants to lasers is not clearly understood, but suggests laser light is not an highly aversive agent (Glahn et al. 2000). Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing pigeons and mallard with birds habituating in approximately 5 minutes and 20 minutes, respectively

(Blackwell et al. 2002). Canada geese reacted to the laser displaying neophobic avoidance to the approaching laser beam.

Vultures respond readily to lasers. In Florida, a roost of over 250 vultures in a residential neighborhood was dispersed after a laser was used there during 4 consecutive evenings. No habituation to the laser was noted. However, the birds returned 2 days later after laser harassment had ceased (M. Avery, NWRC, pers. commun.). At three other roosts, similar short-term responses were observed. It appears that lasers can provide short-term vulture control, but there long-term effectiveness remains to be determined. As with other BDM tools, lasers are best viewed as components of an integrated management effort.

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas that may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective but time-consuming method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations. This method poses no imminent danger to pets or the public.

Egg addling/destruction is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid which covers the entire egg and prevents the egg from obtaining oxygen (see *Egg oiling* below). Although WS does not commonly use egg addling or destruction, it is a valuable damage management tool and has shown to be effective.

Live traps include:

Clover, funnel, and common pigeon traps are enclosure traps made of nylon netting or hardware cloth and come in many different sizes and designs, depending on the species of birds being captured. The entrances of the traps also vary greatly from swinging-door, one-way door, funnel entrance, to tip-top sliding doors. Traps are baited with grains or other food material which attract the target birds. WS' standard procedure when conducting pigeon trapping operations is to ensure that an adequate supply of food and water is in the trap to sustain captured birds for several days. Active traps are checked daily, every other day, or as appropriate, to replenish bait and water and to remove captured birds.

Decoy traps are used by WS for preventive and corrective damage management. Decoy traps are similar in design to the Australian Crow Trap as reported by Johnson and Glahn (1994) and McCracken (1972). Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. Active decoy traps are monitored daily, every other day, or as appropriate, to remove and euthanize excess birds and to replenish bait and water. Decoy traps and other cage/live traps, as applied and used by WS, pose no danger to pets or the public and if a pet is accidentally captured in such traps, it can be released unharmed.

Mist nets are more commonly used for capturing small-sized birds such as house sparrows, finches, etc. but can be used to capture larger birds such as ducks and ring-neck pheasants or even smaller nuisance hawks and owls. It was introduced in to the United States in the 1950's from Asia and the Mediterranean where it

was used to capture birds for the market (Day et al. 1980). The mist net is a fine black silk or nylon net usually 3 to 10 feet wide and 25 to 35 feet long. Net mesh size determines which birds can be caught and overlapping "pockets" in the net cause birds to entangle themselves when they fly into the net.

Cannon nets are normally used for larger birds such as pigeons, feral ducks, and waterfowl and use mortar projectiles to propel a net up and over birds that have been baited to a particular site. This type of net is especially effective for waterfowl that are flightless due to molting and other birds which are typically shy to other types of capture.

Swedish Goshawk traps are large cage type traps used for catching large birds of prey such as hawks and owls. These traps are two part traps with live bait (pigeons, rabbits, or starlings) placed in the lower section. The birds of prey are captured, when then investigate the prey and perch on the trigger bar causing them to fall into the upper portions of the trap, which closes around the bird.

Bal-chatri traps are small traps used for capturing birds of prey such as hawks and owls. Live bait such as pigeons, starlings, rodents, etc. are used to lure raptors into landing on the trap (Hygnstrom and Craven 1994) where nylon nooses entangle their feet and hold the bird. The trap is made of chicken wire or other wire mesh material which is formed into a Quonset hut-shaped cage that holds the live bait. The outside top and sides are covered with many nooses consisting of strong monofilament line or stiff nylon string.

Bow nets are small circular net traps used for capturing birds. The nets are hinged and spring loaded so that when the trap is set it resembles a half moon. The net is set over a food source and it triggered by an observer using a pull cord.

Hand nets are used to catch birds in confined areas such as homes and businesses. These nets resemble fishing dip nets with the exception that they are larger and have long handles.

Net guns are devices used to trap birds. The devices project a net over at target using a specialized gun.

NONLETHAL METHODS - CHEMICAL

Egg oiling is method of suppressing reproduction of nuisance birds by spraying a small quantity of mineral oil or food grade corn oil on eggs in nests. The oil prevents exchange of gases and causes asphyxiation of developing embryos and has been found to be 96-100% effective in reducing hatchability. (Pochop 1998; Pochop et al. 1998). The method has an advantage over nest or egg destruction in that the incubating birds generally continue incubation and do not re-nest. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under FIFRA. To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a nest and at least five days before anticipated hatching. This method is extremely target specific and is less labor intensive than egg addling.

Methyl anthranilate (artificial grape flavoring used in foods and soft drinks for human consumption) could be used or recommended by WS as a bird repellent. Methyl anthranilate (MA) (artificial grape flavoring food additive) has been shown to be an effective repellent for many bird species, including waterfowl (Dolbeer et al. 1993). Methyl anthranilate (MA) is also under investigation as a potential bird taste repellent. MA may become available for use as a livestock feed additive (Mason et.al. 1984; 1989). It is registered for applications to turf or to surface water areas used by unwanted birds. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[3]),

[3] An LD_{50} is the dosage in milligrams of material per kilogram of body weight, or, in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.

nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[4]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and is used as a food additive and perfume ingredient (Dolbeer et al. 1992; RJ Advantage, Inc. 1997). It has been listed as "Generally Recognized as Safe" (GRAS) by the U.S. Food and Drug Administration (Dolbeer et al. 1992).

Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb. with retreating required every 3-4 weeks (RJ Advantage, Inc. 1997). An example of the level of expense involved is a golf course in Rio Rancho, NM where it was estimated that treating four watercourse areas would cost in excess of $25,000 per treatment for material alone. Cost of treating turf areas would be similar on a per acre basis. Also, MA completely degrades in about 3 days when applied to water (RJ Advantage, Inc. 1997) which indicates the repellent effect is short-lived.

Another potentially more cost effective method of MA application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site (Dr. P. Vogt, RJ Advantage, Inc., pers. comm. 1997). Applied at a rate of about .25 lb./ acre of water surface, the cost is considerably less than when using the turf or water treatment methods.

MA is also being investigated as a livestock feed additive to reduce or prevent feed consumption by birds. Such chemicals undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by U.S. Environmental Protection Agency (EPA) or the Food and Drug Administration (FDA).

Particulate feed additives have been investigated for their bird-repellent characteristics. In pen trials, starlings rejected grain to which charcoal particles were adhered (L. Clark, National Wildlife Research Center, pers. comm. 1999). If further research finds this method to be effective and economical in field application, it might become available as a bird repellent on livestock feed. Charcoal feed additives have been explored for use in reducing methane production in livestock and should have no adverse effects on livestock, on meat or milk production, or on human consumers of meat or dairy products (L. Clark, NWRC, pers. comm. 1999).

Other chemical repellents. A number of other chemicals have shown bird repellent capabilities. Anthraquinone, a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998). This chemical is not yet registered in the U.S. but may become available at some future date. Compounds extracted from common spices used in cooking and applied to perches in cage tests have been shown repellent characteristics against roosting starlings (Clark 1997). Napthalene (moth balls) was found to be ineffective in repelling starlings (Dolbeer et al. 1998).

Tactile repellents. A number of tactile repellent products are on the market, which reportedly deter birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that the birds avoid. However, experimental data in support of this claim are sparse (Mason and Clark 1989). The repellancy of tactile products is generally short-lived because of dust, and they sometimes cause aesthetic problems and expensive clean-up costs by

[4] An LD_{50} is the dosage in milligrams of material per liter of air required to cause death in 50% of a test population of a species through inhalation.

running down the sides of buildings in hot weather.

Avitrol is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits, normally in a 1:9 ratio. Avitrol, however, is not completely non-lethal because a small portion of the birds are generally killed (Johnson and Glahn 1994). Pre-baiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, gulls, blackbirds, starlings, and English sparrows in various situations. Avitrol treated bait is placed in an area where the targeted birds are feeding and usually a few birds will consume a treated bait and become affected by the chemical. The affected birds then broadcast distress vocalizations and display abnormal flying behavior, thereby frightening the remaining flock away.

Avitrol is a restricted use pesticide that can only be sold to certified applicators and is available in several bait formulations where only a small portion of the individual grains carry the chemical. It can be used during anytime of the year, but is used most often during winter and spring. Any granivorous bird associated with the target species could be affected by Avitrol. Avitrol is water soluble, but laboratory studies demonstrated that Avitrol is strongly absorbed onto soil colloids and has moderately low mobility. Bio-degradation is expected to be slow in soil and water, with a half-life ranging from three to 22 months. However, Avitrol may form covalent bonds with humic materials, which may serve to reduce its availability for intake by organisms from water, is non-accumulative in tissues and rapidly metabolized by many species (Schafer 1991).

Avitrol is acutely toxic to avian and mammalian species, however, blackbirds are more sensitive to the chemical and there is little evidence of chronic toxicity. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning, and during field use only magpies and crows appear to have been affected (Schafer 1991). However, a laboratory study by Schafer et al. (1974) showed that magpies exposed to two to 3.2 times the published Lethal Dose (LD_{50}) in contaminated prey for 20 days, were not adversely affected and three American kestrels that were fed contaminated blackbirds for seven to 45 days were not adversely affected. A formal Risk Assessment found no probable risk is expected for pets and the public, based on low concentrations and low hazards quotient value for non-target indicator species tested on this compound (USDA 1997, Appendix P).

Alpha-chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove nuisance waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981), but is typically used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as a well-contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. WS personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis in USDA (1997) based on critical element screening, therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bio-accumulation in plants and animal tissue is believed to be low. Alpha-chloralose is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990) but the compound is not generally soluble in water and therefore should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, nontarget species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA rather than a pesticide.

LETHAL METHODS - MECHANICAL

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when large numbers of birds are present. Normally shooting is conducted with shotguns, rifles, or air rifles. Shooting is a very individual specific method and is normally used to remove a single offending bird. However, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce non-lethal methods. Shooting can be relatively expensive because of the staff hours sometimes required (USDA 1997). It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with shotguns, air rifles, or rim and center fire firearms is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. WS follows all firearm safety precautions when conducting BDM activities and all laws and regulations governing the lawful use of firearms are strictly complied with.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 2 years afterwards (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Sport Hunting is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted, and activities can meet property security and safety compliance. A valid hunting license and other licenses or permits may be required by the Indiana Department of Natural Resources (IDNR) and USFWS for certain species. This method provides sport and food for hunters and requires no cost to the landowner. Sport hunting is occasionally recommended if it can be conducted safely for pigeon damage management, Canada geese, and other damage causing waterfowl.

Snap traps may be modified to remove individual woodpeckers, starlings, and other cavity use birds. The trap treadle is baited with taste attractants and attached near the damage area. These traps pose no imminent danger to pets or the public.

Cervical Dislocation is sometimes used to euthanize birds which are captured in live traps and when relocation is not a feasible option. The bird is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA approves this technique as humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry and other small birds (Beaver et al 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al 2001).

LETHAL METHODS - CHEMICAL

All chemicals used by WS are registered as required by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (administered by the EPA and the Indiana Department of Natural Resources (IDNR) or by the FDA. WS personnel that use restricted-use chemical methods are certified as pesticide applicators by IDNR and are required to adhere to all certification requirements set forth in FIFRA and Indiana pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner/manager.

CO_2 is sometimes used to euthanize birds which are captured in live traps and when relocation is not a feasible option. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. CO_2 gas

is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the American Veterinary Medical Association (Beaver et al 2001). CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

DRC-1339 is the principal chemical method that would be used for starling/blackbird and pigeon damage management in the proposed action. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon control at feedlots, dairies, airports, and in urban areas (West et al. 1967, Besser et al. 1967, Decino et al. 1966). Studies continue to document the effectiveness of DRC-1339 in resolving blackbird starling problems at feedlots (West and Besser 1976, Glahn 1982, Glahn et al. 1987), and Blanton et al. (1992) reports that DRC-1339 appears to be a very effective, selective, and safe means of urban pigeon population reduction. Glahn and Wilson (1992) noted that baiting with DRC-1339 is a cost-effective method of reducing damage by blackbirds to sprouting rice.

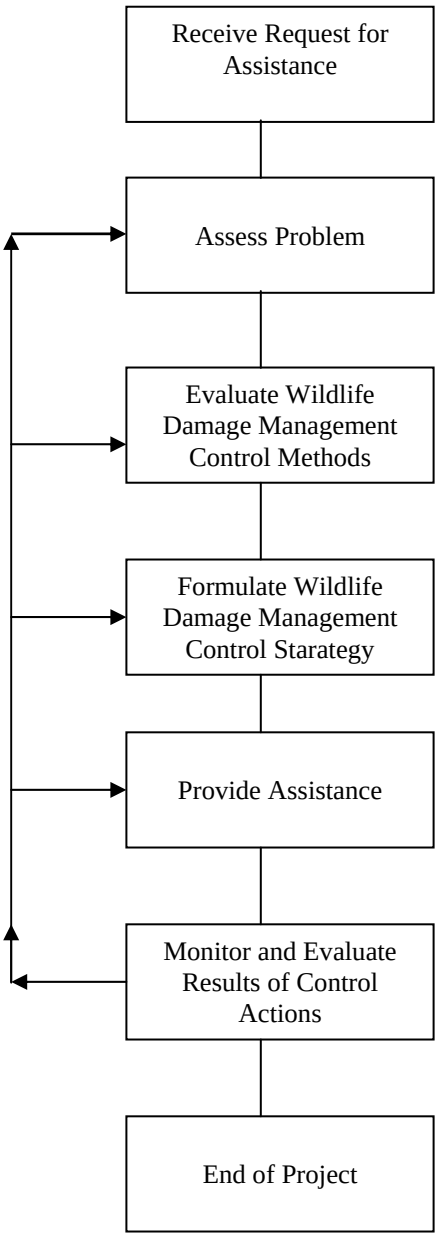
DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species but only slightly toxic to nonsensitive birds, predatory birds, and mammals. For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens are highly sensitive to DRC-1339. Many other bird species such as raptors, sparrows, and eagles are classified as nonsensitive. Numerous studies show that DRC-1339 poses minimal risk of primary poisoning to nontarget and T&E species (USDA 1997). Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost nonexistent. DRC-1339 acts in a humane manner producing a quiet and apparently painless death.

DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (i.e., degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (USDA 1997). Appendix P of USDA (1997) contains a thorough risk assessment of DRC-1339 and the reader is referred to that source for a more complete discussion. That assessment concluded that no adverse effects are expected from use of DRC-1339.

DRC-1339 has several EPA Registration Labels (56228-10, 56228-17, 56228-28, 56228-29, and 56228-30) depending on the application or species involved in the BDM project.

Appendix C

Wildlife Services Decision Model



Appendix D

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